SOIL SURVEY OF

Wayne County, Nebraska

NOTICE – Potential Update
Soils information in this manuscript is current as of the publication date. Situations like erosion, floods, or updated mapping may have changed some content slightly on a few acres. The most current soils information is available on-line at the Nebraska NRCS web site home page, in the e-FOTG (electronic Field Office Technical Guide). The website is www.ne.nrcs.usda.gov, then click on e-FOTG. This data is also available at the NRCS Field Office serving this county.

United States Department of Agriculture
Soil Conservation Service
In cooperation with
University of Nebraska
Conservation and Survey Division

Issued February 1975

Major fieldwork for this soil survey was done in the period 1963–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska Conservation and Survey Division. It is part of the technical assistance furnished to the Lower Elkhorn Natural Resource District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and windbreaks; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Wayne County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" at the back of this survey can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability unit, range site, and windbreak suitability group to which each soil belongs. It also shows the page where each soil is described and the pages where the capability unit, range site, and windbreak suitability group are discussed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the range sites, and the windbreak suitability groups.

Ranchers and others can find, under "Management of the Soils for Range," groupings of the soils according to their suitability for range and also the names of many of the plants that grow on each range site.

Foresters and others can refer to the section "Management of the Soils for Woodland and Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Management of the Soils for Wildlife."

Community planners, engineers, and builders can read about soil properties that affect the choice of sites for dwellings, industrial buildings, roads, and other engineering works, and recreation areas in the section "Engineering Uses of the Soils." They also can find, in the same section, tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to Wayne County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: **Terraces and grassed waterways on soils of the Moody-Nora-Judson association.**

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Issued February 1975

SOIL SURVEY OF WAYNE COUNTY, NEBRASKA

BY DONALD E. KERL, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA, CONSERVATION AND SURVEY DIVISION

WAYNE COUNTY is in the northeastern part of Nebraska (fig. 1) and has an area of 443 square miles, or 283,520 acres. It is L-shaped and is approximately 28 miles long and 18 miles wide in its greatest dimensions. The landscape consists almost wholly of gently sloping to steep upland. Most of the soils formed in Peoria loess. Wayne, the county seat, is the largest town in the county. Wayne State College is located there.

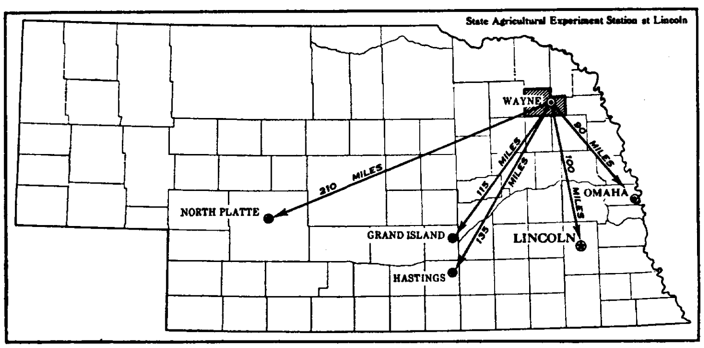

Figure 1.—**Location of Wayne County in Nebraska.**

The economy of Wayne County is based on grain production and feeding cattle and hogs. Corn is the principal crop. Soybeans, oats, sorghum, and alfalfa are other important crops. All the locally grown grains and alfalfa plus additional amounts shipped in are used in the livestock feeding operations. Bottom land subject to wetness due to flooding or a high water table is used for pasture.

An older soil survey of Wayne County was published in 1919 (*3*).[1] The present survey provides the additional and updated information needed because of technical advances in farming methods, engineering techniques, and soil classification.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Wayne County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. In addition to collecting many facts about the soils, they observed the steepness, length, and shape of slopes; drainage characteristics; and the kinds of native plants and crops. They also dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in countries nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Moody and Nora, for example, are the names of two soil series. In the United States all soils having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Crofton silt loam, 2 to 7 percent slopes, eroded, is one of several phases within the Crofton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have

[1] Italic numbers in parentheses refer to Literature Cited, p. 58.

been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Wayne County—soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. The Hadar-Thurman complex, 5 to 15 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils joined by "and". Colo and Lamo silty clay loams is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. Such places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Wet alluvial land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Wayne County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare soils in different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soil associations in Wayne County are discussed in the following pages. The names and delineations on the general soil map at the back of this survey do not agree fully with those on the general soil maps for adjacent counties published at an earlier date. Differences in these maps are the result of improvement in the classification and refinements in the concept of the soil series. Also, more detailed and precise maps are needed now because uses of the general soil map have increased in recent years. Maps such as the one in this survey meet modern needs.

1. Nora-Thurman Association

Very gently sloping to moderately steep, deep, well drained to somewhat excessively drained silty, loamy, and sandy soils on uplands

This association consists mostly of very gently sloping soils on ridgetops and of moderately steep soils on the sides of ridges. It also includes soils on narrow foot slopes, wider stream terraces, and narrow bottom lands along drainageways.

This association occupies about 4 percent of the county. Nora soils make up about 50 percent of the association and Thurman soils about 21 percent. The remaining 29 percent consists of minor soils.

Nora soils are mainly on narrow ridgetops and sides of ridges. Their surface layer is silt loam or fine sandy loam. The subsoil is silty clay loam and silt loam, and the underlying material is silt loam. These soils are deep, friable, and well drained.

Thurman soils are mostly gently sloping and on uplands. In places, they border intermittent drainageways. Their surface layer is loamy fine sand, and beneath it is a transition layer also consisting of loamy fine sand. The underlying material is loamy fine sand and find sand. These soils are deep and somewhat excessively drained.

The minor soils in this association are in the Blendon, Hadar, Crofton, Moody, Ortello, and Valentine series. Blendon soils are on stream terraces along some of the broad drainageways. Hadar soils are above Thurman soils in the middle parts of the landscape. Crofton soils border drainageways and also are on some of the highest

ridgetops. Moody soils have concave slopes that border drainageways and are on broad ridgetops. Ortello soils are gently undulating soils on sand-mantled ridges. Valentine soils are on the highest parts of the landscape.

About 75 percent of this association is dry-farmed. Alfalfa, corn, and grain sorghum are main crops. The rest of the acreage is in grass, of which 20 percent is pasture and 5 percent is range. Cow-calf operations can be increased. Water erosion, soil blowing, and drought are the main hazards in cultivated areas, and soil blowing is the principal hazard on range. Conserving water and maintaining fertility are the chief concerns of management in cultivated areas. Where soils are eroded, the organic-matter content needs to be increased. Pasture and range need proper management, including control of soil blowing and water erosion. Eroded, steeper sandy soils need to be seeded to native or tame grass. Bottom lands along drains are subject to flooding.

The average farm is between 400 and 800 acres in size. As gravel or improved dirt roads are on most section lines, farmers have good access to markets. Hoskins, which is in the area of this association, and Norfolk, about 8 miles southwest of Hoskins, are the major markets. These towns are connected by a paved highway.

2. Nora-Moody Association

Gently sloping to moderately steep, deep, well-drained silty soils on loess-mantled uplands

This association consists of gently sloping soils on broad divides and narrow ridgetops and moderately sloping to moderately steep soils on the sides of ridges. It also includes soils on narrow foot slopes that border the adjacent uplands. The dissected landscape has many small intermittent drainageways that merge into larger drainageways. Local relief is about 100 feet. Slopes 1,000 feet in length are common.

This association occupies about 60 percent of the county. Nora soils make up about 45 percent of the association and Moody soils about 30 percent. The remaining 25 percent consists of minor soils.

Nora soils are mainly on narrow ridgetops and sides of ridges. Their surface layer and subsoil are silt loam and silty clay loam, and the underlying material is silt loam. They are deep, friable, and well drained.

Moody soils are on broad divides, ridgetops, and concave slopes that border drainageways. Their surface layer and subsoil are silty clay loam, and the underlying material is a lighter colored silt loam. They are deep, friable, and well drained.

The minor soils in this association are in the Kennebec, Crofton, Judson, and Thurman series. Kennebec soils are on bottom lands of narrow drainageways. Crofton soils border some of the more deeply entrenched drainageways. Judson soils are on colluvial foot slopes that border drainageways. The gently undulating Thurman soils are on sand-mantled uplands.

Most of this association is dry-farmed, but some is irrigated by central pivot systems. Corn, alfalfa, grain sorghum, and soybeans are the principal crops. Some of the steeper soils and eroded areas have been seeded to grasses and are used for pasture. A few areas are in native grass. Reseeding some of the steeper, eroded slopes to grass would increase the potential for raising beef cattle.

Erosion by water is the principal hazard, and conserving water and maintaining fertility are the main concerns in cultivated areas. Flooding is a hazard on bottom lands of the narrow upland drainageways. The organic-matter content of eroded soils needs to be increased.

Fattening cattle in feedlots is a major enterprise in the area of this association. Most crops are fed to cattle. Farms are mainly a combination of the cash-grain and livestock type. The average farm is between 400 and 640 acres in size. Gravel or improved dirt roads are on most section lines and several paved highways cross the area. Grain and livestock markets are readily available within the county as well as in adjacent counties.

3. McPaul-Lamo-Kennebec Association

Nearly level, deep, moderately well drained to somewhat poorly drained silty soils on bottom lands

This association consists of nearly level soils on bottom lands of the major creeks and their larger tributaries. It also includes soils on narrow foot slopes that border the adjacent uplands. Except in a few places where the channels have been straightened, the creeks meander through the bottom lands. The creek channels are narrow and moderately deep. During periods of high rainfall, most of the creeks overflow and flood the bottom lands. The soils on bottom lands have a moderately high water table in places.

This association occupies about 10 percent of the county. McPaul soils make up about 40 percent of the association, Lamo soils about 20 percent, and Kennebec soils 20 percent. The remaining 20 percent consists of minor soils.

McPaul soils are on flood plains. They are silt loam throughout their profile and are deep, friable, and moderately well drained. Nearly every year, floods deposit sediment on the surface of the soil.

Lamo soils are on wide bottom lands. They are silty clay loam throughout their profile and are deep, friable, and somewhat poorly drained.

Kennebec soils are on wide bottom lands that are better drained and slightly higher in the landscape than are the areas of Lamo soils. They are silt loam throughout their profile and are deep, friable, and moderately well drained.

The minor soils in this association are in the Zook, Colo, Judson, and Loretto series. Wet alluvial land also is included. Zook soils are on bottom lands of some of the larger creeks, and Colo soils are on bottom lands of narrow drainageways. Judson soils are on colluvial foot slopes that border bottom lands. Loretto soils are on stream terraces along Logan Creek. Wet alluvial land is in the lowest areas of the bottom lands.

Most of this association is dry-farmed, but some is irrigated from shallow wells. Corn, soybeans, and alfalfa are the principal crops. Areas that are subject to flooding or wetness are used for pasture. Trees grow along the creeks. This association is well suited to irrigation from shallow wells. Conserving water and maintaining good tilth and fertility are the main concerns of management. Flooding and prolonged wetness of soils are the hazards in areas adjacent to creeks.

Fattening livestock in feedlots is a major enterprise. Most farms are a combination of the cash-grain and livestock type. The average farm is between 240 and 400 acres in size. Gravel or improved dirt roads are on most

section lines, and several paved highways cross areas of this association.

4. Moody-Nora-Judson Association

Very gently sloping to moderately sloping, deep, well-drained silty soils on dissected loess-mantled uplands

This association consists of rolling soils on broad uplands. It also includes soils on narrow foot slopes adjacent to the uplands. Local relief is about 100 feet. Slopes commonly are 1,200 to 2,000 feet in length. Gradients range from 1 to 11 percent but generally are from 3 to 9 percent.

This association occupies about 23 percent of the county. Moody soils make up about 40 percent of the association, Nora soils about 25 percent, and Judson soils 15 percent (fig. 2). The remaining 20 percent consists of minor soils.

The very gently sloping Moody soils are on ridgetops and concave slopes. They are well-drained soils that have a silty clay loam surface layer and subsoil and a silt loam underlying material.

Nora soils are mainly on convex ridges. They are well drained and have a silt loam or silty clay loam surface layer and subsoil and silt loam underlying material.

Judson soils are on colluvial foot slopes along drainageways. They are well drained and have a silt loam and silty clay loam surface layer and a silty clay loam subsoil.

The minor soils in this association are in the Lamo, Kennebec, Belfore, and Fillmore series. Lamo soils are in swales on bottom lands and Kennebec soils are on the

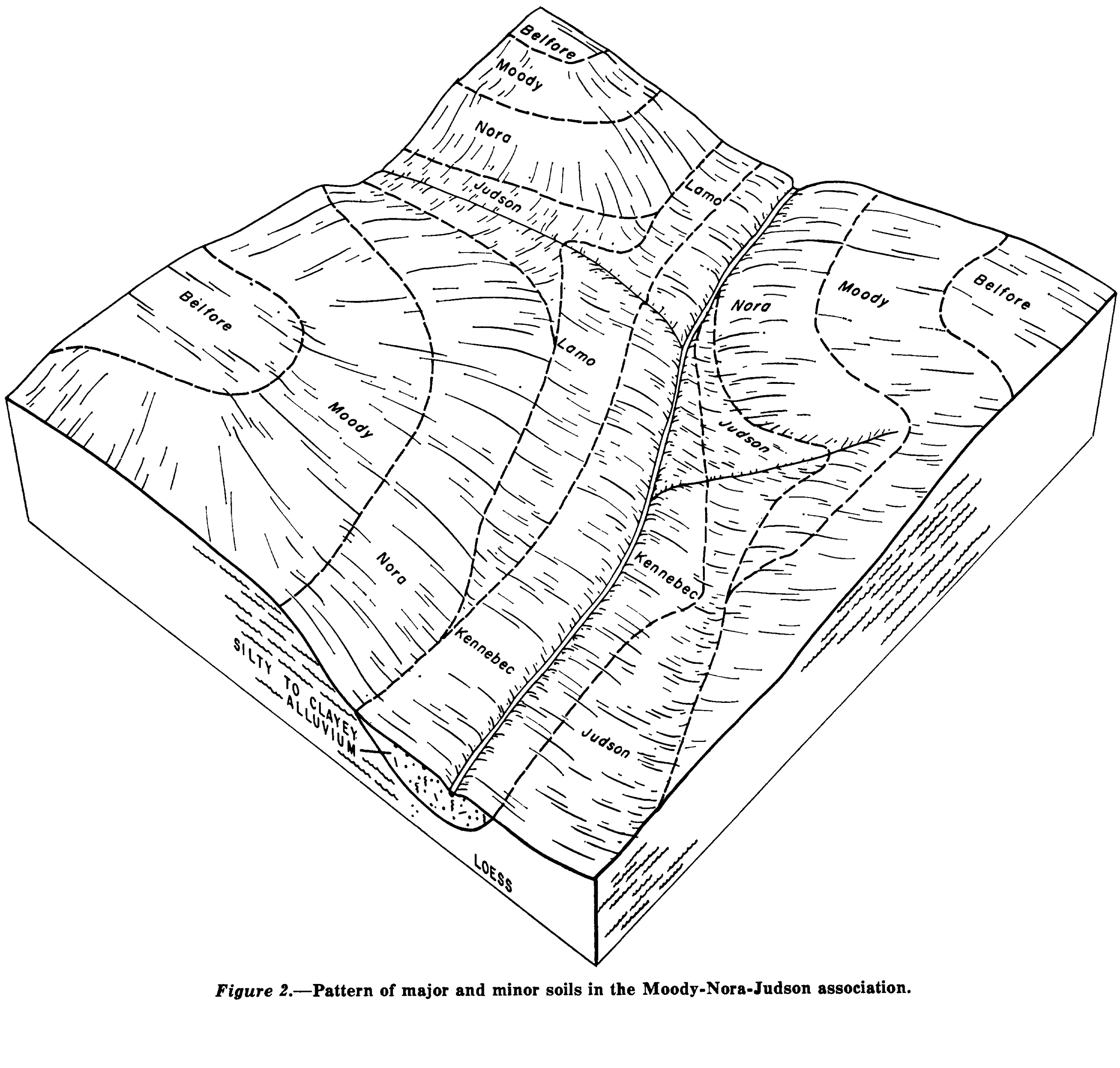

***Figure 2.*—Pattern of major and minor soils in the Moody-Nora-Judson association.**

higher parts of bottom lands. Belfore soils are nearly level to very gently sloping and are on ridgetops. Fillmore soils are poorly drained and are in depressions on the uplands.

About 95 percent of this association is dry-farmed. Soybeans, corn, grain sorghum, red clover, and alfalfa are the principal crops. Small areas along narrow bottom lands of upland drains are in pasture or range.

Erosion by water is the principal hazard on the uplands. Flooding is a hazard, and wetness limits the use of the soils on bottom lands. Conserving water and maintaining good tilth and fertility are the main concerns of management.

The grain raised on most farms is fed to cattle or hogs that are being fattened for market. Soybeans are a cash crop. The average farm is between 320 and 480 acres in size. Dirt or gravel roads are on most section lines, and several paved highways cross the area. Thus, farmers have good access to markets. Wayne is the main market near this area. Wakefield in adjacent Dixon County and other markets in nearby counties are also available.

5. Nora-Crofton Association

Moderately sloping to moderately steep, eroded, deep, well-drained silty soils on dissected loess-mantled uplands

This association consists of moderately sloping to moderately steep soils on narrow divides, ridgetops, and long slopes to drainageways. Narrow foot slopes are between the adjacent uplands and the flat bottom lands.

This association (figs. 3 and 4) occupies only about 3 percent of the county. Nora soils make up about 50 percent of the association and Crofton soils about 30 percent. The remaining 20 percent consists of minor soils.

Nora soils are on narrow ridgetops and have slightly convex slopes. Their surface layer and subsoil are silty clay loam and silt loam, and the underlying material is silt loam. They are deep, friable, and well drained.

Crofton soils are mainly on narrow ridgetops and in convex areas that border intermittent drainageways. They are deep, well-drained, eroded soils that are silt loam throughout their profile. They generally are on the highest part of the landscape.

The minor soils in this association are in the Moody, Judson, and McPaul series. Moody soils are on broad ridgetops and concave areas that border drainageways. Judson soils are on colluvial foot slopes and border upland drainageways. McPaul soils are on bottom lands along narrow drainageways.

About 80 percent of this association is dry-farmed, and about 20 percent is in tame grass that is used as pasture. Alfalfa, corn, and grain sorghum are the principal crops. Erosion by water is the principal hazard on cultivated soils and tame pasture. Flooding is a hazard on bottom lands of the narrow upland drainageways. Conserving water and maintaining fertility are the principal concerns in proper management. The organic-matter content of eroded soils needs to be increased.

Most farms in this association are a combination of the cash-grain and livestock type. Much of the grain is used to fatten cattle and hogs. The average farm is between 400 and 640 acres in size. Graveled or improved roads and one paved highway cross the area. Norfolk, in Madison County, is the major market for this area.

Descriptions of the Soils

This section describes the soil series and mapping units in Wayne County. Each soil series is described in detail, and then each mapping unit in that series is described briefly. Unless specifically indicated otherwise, statements about the soil series should be assumed to hold true for all mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which the unit belongs.

An important part of the information for each soil series is the soil profile—that is, the sequence of layers from the surface downward to a depth of 60 inches. For each profile, there are two descriptions. The first is brief and in terms familiar to the layman. The second is much more detailed and is for scientists, engineers, and others who make highly technical interpretations.

The profile described is representative for mapping units in the series. If the profile of a given mapping unit differs from the one described for the series, the differences are stated in the description of the mapping unit or are apparent in the name of the mapping unit. Unless it is otherwise noted, the colors given in the descriptions are those of a dry soil and the terms for consistence are those of a moist soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Wet alluvial land, for example, does not belong to a soil series, but, nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and windbreak suitability group in which the mapping unit has been placed. The page for the description of each capability unit, range site, and windbreak suitability group is given in "Guide to Mapping Units" at the back of this survey.

Many of the terms used in describing soils can be found in the Glossary, which immediately precedes "Guide to Mapping Units," and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*4*).

The acreage and proportionate extent of each mapping unit are shown in table 1.

Names of soils, descriptions of soils, and boundaries of soils do not agree fully with those in surveys of adjacent counties published at an earlier date. Differences in the maps result from a better knowledge of soils, modifications in the concept of the soil series, changes in intensity of mapping, and relative extent of soils within the areas surveyed.

Belfore Series

The Belfore series consists of deep, moderately well drained soils on the uplands. These soils formed in thick deposits of loess and are nearly level to very gently sloping.

In a representative profile, the surface layer is silty clay loam about 11 inches thick. It is dark gray in the

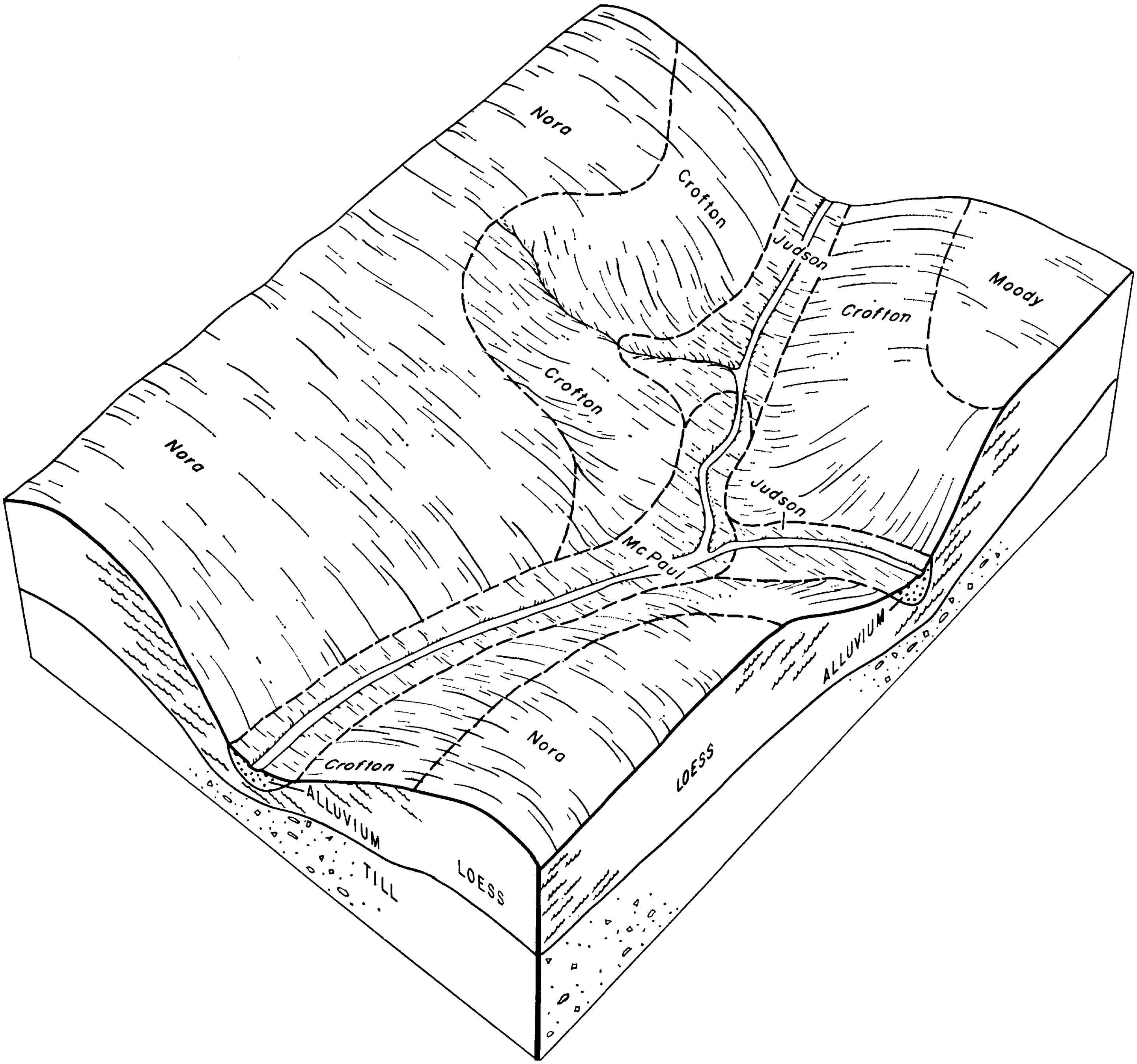

***Figure 3.*—Pattern of soils in the Nora-Crofton association**

upper part and dark grayish brown in the lower part. The subsoil is about 34 inches thick. Except for the top 4 inches, which is friable, dark-brown silty clay, it consists of friable, brown silty clay loam. The underlying material, below a depth of 45 inches, is pale-brown silt loam.

Belfore soils have moderately slow permeability, high available water capacity, and high organic-matter content. They release moisture readily to plants. Soil reaction is slightly acid in the upper part of the surface layer and is neutral throughout the rest of the profile.

These soils are well suited to most locally grown crops. They also are suited to grasses and windbreaks, which provide habitat for wildlife.

Representative profile of Belfore silty clay loam, 0 to 1 percent slopes, in a cultivated field, 550 feet west and 162 feet south of the northeast corner of sec. 12, T. 26 N., R. 3 E.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate, coarse, prismatic structure parting to moderate, fine, granular structure; soft, friable; slightly acid; abrupt, smooth boundary.

Figure 4.—**Typical area in the Nora-Crofton association. Light-colored areas are Crofton soils and darker areas are Nora soils.**

A3—7 to 11 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark brown (10YR 2/2) moist, very dark grayish brown (10YR 3/2) rubbed; moderate, coarse, prismatic structure parting to moderate, fine and medium, granular structure; slightly hard, friable; shiny faces of peds; neutral; clear, smooth boundary.

B21t—11 to 15 inches, dark-brown (10YR 4/3) silty clay, very dark grayish brown (10YR 3/2) moist, dark brown (10YR 4/3) rubbed; moderate, coarse, prismatic structure parting to moderate, fine, angular blocky structure; hard, friable; shiny vertical and horizontal faces of peds; neutral; gradual, smooth boundary.

B22t—15 to 22 inches, brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 3/3) moist, dark brown (10YR 4/3) rubbed; moderate, coarse, prismatic structure parting to moderate, fine, angular blocky structure; hard, friable; shiny vertical and horizontal faces of peds; neutral; gradual, smooth boundary.

B23t—22 to 36 inches, brown (10YR 5/3) silty clay loam, dark-brown (10YR 3/3) vertical faces and dark-brown (10YR 4/3) horizontal faces of peds; moist; weak, coarse, prismatic structure parting to moderate, coarse, angular blocky structure; hard, friable; shiny surfaces on vertical faces of peds; organic matter in root channels; neutral; gradual, wavy boundary.

B3—36 to 45 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak, coarse, angular blocky structure; hard, friable; few, fine, prominent, very dark brown, shotlike segregations; organic matter in root channels; neutral; gradual, wavy boundary

C—45 to 60 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; slightly hard, very friable; few, fine, prominent, very dark brown, shotlike segregations; neutral.

The A horizon ranges from 10 to 16 inches in thickness and is very dark gray to dark grayish brown. The B horizon ranges from 20 to 40 inches in thickness and is dark brown to pale brown. Gray to yellowish-red and strong-brown mottles are common in the lower part of the B horizon and in the C horizon in some areas. The C horizon is calcareous at a depth of 50 to 70 inches.

Belfore soils are associated with Moody and Fillmore soils. They have a finer textured, more strongly developed B horizon than Moody soils. Their B horizon is lighter colored than that of Fillmore soils, and they have an A3 horizon but no A2 horizon.

Belfore silty clay loam, 0 to 1 percent slopes (BeA).—This soil is on uplands and occurs in irregular areas 20 to 60 acres in size. Its profile is the one described as representative of the Belfore series. In places the subsoil has reddish-brown mottles. Included with this soil in mapping were small areas of Moody soils at slightly higher elevations and small areas of Fillmore soils in depressions.

Runoff is slow. The surface soil has good workability through only a narrow range of moisture content. If worked when wet, the plow layer becomes cloddy upon drying and the layer immediately beneath is compacted. Weed control is difficult because cultivation must be delayed until moisture conditions are suitable.

Much of the Belfore silty clay loam is planted to soybeans and corn. This soil also is well suited to most other crops commonly grown in the county; it is better suited

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Belfore silty clay loam, 0 to 1 percent slopes	8,200	2.9	Moody silty clay loam, 7 to 11 percent slopes	48,850	17.2
Belfore-Moody silty clay loams, 1 to 3 percent slopes	3,750	1.3	Moody silty clay loam, 7 to 11 percent slopes, eroded	3,450	1.2
Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes	1,100	.4	Moody and Nora soils, 0 to 5 percent slopes	580	.2
Colo silt loam, occasionally flooded	1,600	.6	Moody and Nora soils, 5 to 11 percent slopes	600	.2
Colo silty clay loam, drained	3,800	1.3	Nora silt loam, 2 to 7 percent slopes, eroded	13,100	4.6
Colo and Lamo silty clay loams	2,600	.9	Nora silt loam, 7 to 11 percent slopes, eroded	53,090	18.7
Crofton silt loam, 2 to 7 percent slopes, eroded	2,600	.9	Nora silt loam, 11 to 17 percent slopes, eroded	11,400	4.0
Crofton silt loam, 7 to 11 percent slopes, eroded	11,200	4.0	Nora-Moody silty clay loams, 7 to 11 percent slopes	17,000	6.0
Crofton silt loam, 11 to 20 percent slopes, eroded	1,700	.6	Nora-Moody silty clay loams, 11 to 17 percent slopes	6,800	2.4
Fillmore complex	210	.1	Ortello fine sandy loam, 1 to 5 percent slopes	1,100	.4
Hadar-Thurman complex, 5 to 15 percent slopes	346	.1	Ortello fine sandy loam, 5 to 11 percent slopes	760	.3
Judson silt loam, 2 to 7 percent slopes	19,200	6.8	Thurman loamy fine sand, 2 to 7 percent slopes	1,200	.4
Kennebec silt loam	7,400	2.6	Thurman loamy fine sand, 7 to 15 percent slopes	740	.3
Lamo silt loam, occasionally flooded	1,000	.3	Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes	446	.2
Lamo silty clay loam	7,500	2.6	Valentine loamy fine sand, rolling	180	.1
Loretto fine sandy loam, 0 to 2 percent slopes	154	.1	Wet alluvial land	254	.1
McPaul silt loam	14,000	4.9	Zook silty clay loam	500	.2
McPaul silt loam, wet	5,050	1.8			
Moody silt loam, 2 to 7 percent slopes	560	.2			
Moody silty clay loam, 2 to 7 percent slopes	31,500	11.1	Total	283,520	100.0

to red clover than to alfalfa. Trees grow well in windbreaks. The trees and other vegetation provide habitat for wildlife. (Capability unit I-1; Clayey range site; Silty to Clayey windbreak suitability group)

Belfore-Moody silty clay loams, 1 to 3 percent slopes (BmB).—Soils in this complex are on the uplands in areas ranging from 20 to 60 acres in extent. Belfore silty clay loam is on the more concave parts of the landscape and makes up about 55 percent of the complex. Moody silty clay loam occupies the more convex parts of the landscape and makes up about 40 percent of the complex. The profile of each soil is similar to the one described as representative of its respective series. Included with these soils in mapping were small areas of Fillmore soils, which occur in small depressions. These areas constitute about 5 percent of the complex.

Runoff is slow on the Belfore part of this complex and medium on the Moody part. The surface layer of these soils becomes cloddy if worked when too wet. Erosion by water is the principal hazard, especially on the longer slopes. Maintenance of good tilth is a minor concern.

These soils are used for the principal crops grown in the county. They are particularly well suited to soybeans, and they are better suited to red clover than to alfalfa. Trees grow well in shelterbelts. Food and cover are available to wildlife. (Capability unit IIe-1; Belfore soil is in the Clayey range site and the Moody soil is in the Silty range site; both soils are in Silty to Clayey windbreak suitability group)

Blendon Series

The Blendon series consists of deep, well-drained, loamy soils that formed in eolian deposits. These soils are on narrow, slightly concave foot slopes and on stream terraces.

In a representative profile, the surface layer is fine sandy loam about 17 inches thick. It is dark gray in the upper part and very dark gray in the lower part. The subsoil, about 31 inches thick, is very friable fine sandy loam that is dark grayish brown in the upper part and brown in the lower part. The underlying material is brown fine sandy loam to a depth of 54 inches and dark-gray silty clay below that depth.

Blendon soils have moderately rapid permeability and high available water capacity. They absorb moisture easily and release it readily to plants. They receive runoff from soils at higher elevations. Organic-matter content is moderate. Soil reaction is neutral to a depth of 48 inches and mildly alkaline at greater depths. These soils are easily worked.

Blendon soils are suited to cultivated crops and truck gardening. They are also suited to grass and trees, and they provide habitat for wildlife.

Representative profile of Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes, in a cultivated field, 2,040 feet east and 400 feet south of the northwest corner of sec. 8, T. 25 N., R. 1 E.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A12—7 to 17 inches, very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak, fine, subangular blocky structure parting to weak, very fine, granular structure; soft, friable; neutral; clear, wavy boundary.

B21—17 to 24 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure parting to weak, very fine, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

B22—24 to 48 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure parting to single grained; soft, very friable; neutral; clear, wavy boundary.

C1—48 to 54 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; soft, friable; sand coating on faces of peds; mildly alkaline; abrupt, smooth boundary.

IIC2—54 to 60 inches, dark-gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; massive; very hard, very firm; mildly alkaline.

The A horizon ranges from dark gray to very dark gray. The B horizon is mainly fine sandy loam, but in places the lower part is loamy fine sand. Commonly the B horizon is stratified with thin lenses of medium and moderately fine textured soil material. It ranges from 20 to 40 inches in thickness. The C1 horizon is brown to gray fine sandy loam or loam. Below a depth of 40 inches, finer textured layers commonly are present.

Blendon soils are associated with Ortello, Moody, and Thurman soils. They have a thicker, darker colored A horizon than Ortello soils, are coarser textured than Moody soils, and are finer textured than Thurman soils.

Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes (BnC).—This soil is on long, concave foot slopes and on stream terraces. Included with this soil in mapping were some areas that have layers of silt loam in the subsoil. Small areas of Ortello soils also were included.

Runoff is slow, but water erosion is a hazard in areas adjacent to drainageways. This soil tends to be droughty during periods of low rainfall. Where not protected, it is subject to soil blowing.

Most of the acreage of this soil is cultivated. Corn, alfalfa, and oats are the principal crops. Some of the drainageways have been shaped and then seeded to tame grass for hay. Trees grow well in windbreaks. (Capability unit IIIe-3; Sandy range site; Sandy windbreak suitability group)

Colo Series

The Colo series consists of deep, nearly level, somewhat poorly drained soils that formed in silty alluvium on bottom lands. The water table is at a depth of 2 to 12 feet.

In a representative profile, the surface layer is silty clay loam about 26 inches thick. It is dark gray in the upper part and very dark gray in the lower part. Beneath it is a transition layer that consists of very dark gray silty clay loam about 10 inches thick. The underlying material, below a depth of 36 inches, is mottled silty clay loam. It is dark gray in the upper part and gray in the lower part.

Colo soils have moderately slow permeability, high available water capacity, and high organic-matter content.

Colo soils that are subject to wetness or flooding are used mostly for pasture. They are suited to some kinds of trees, and the vegetation provides habitat for wildlife. Colo soils are suited to cultivated crops.

Representative profile of Colo silty clay loam, in an area of Colo and Lamo silty clay loams, 200 feet west and 100 feet north of the southeast corner of sec. 22, T. 25 N., R. 1 E.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak, very fine, granular structure; slightly hard, friable; mildly alkaline, abrupt, smooth boundary.

A12—7 to 15 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak, fine, granular structure; slightly hard, friable; mildly alkaline; clear, wavy boundary.

A13—15 to 26 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak, medium, granular structure; slightly hard, friable; mildly alkaline; clear, smooth boundary.

AC—26 to 36 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; very hard, firm; mildly alkaline; clear, wavy boundary.

C1g—36 to 44 inches, dark-gray (2.5Y 4/1) silty clay loam, very dark gray (2.5Y 3/1) moist, black (2.5Y 2/2) when crushed; common, fine, reddish-brown (5YR 5/4) mottles masked by organic matter; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; hard, friable; mildly alkaline; clear, wavy boundary.

C2g—44 to 60 inches, gray (2.5Y 5/1) silty clay loam, very dark gray (2.5Y 3/1) moist; common, fine, reddish-brown (5YR 5/4) mottles; massive; hard, friable; moderately alkaline.

The A horizon is 20 to 40 inches thick, ranges from silty clay loam to silt loam, and is dark gray to dark grayish brown. The AC horizon ranges from 6 to 15 inches in thickness. The Cg horizons consist of silty clay loam or silty clay and contain thin layers of silt. They range from gray to very dark gray in color and are of 2.5Y or 5Y hue. The lower part of the soil profile is commonly calcareous.

Colo soils are associated with Lamo and Kennebec soils. They are noncalcareous to greater depths than Lamo soils and have a finer textured C horizon than Kennebec soils.

Colo silt loam, occasionally flooded (0 to 1 percent slopes) (Ca).—This soil is on bottom lands at the mouth of upland drains. It occurs in long areas that parallel upland drainageways and range from 40 to 60 acres in size. Its profile is similar to the one described as representative for the Colo series, but the surface layer is overwash material consisting of silt loam which was deposited by floodwater. This overwash material is 8 to 20 inches thick and is lighter colored than the layer beneath it. Included with this soil in mapping were small areas of Lamo soils and areas that have thicker or thinner deposits of overwash material.

The water table in this Colo soil is at a depth of 2 to 8 feet. Flooding from upland drainageways late in spring and early in summer is a serious hazard, especially to crops such as oats. It commonly delays cultivation of row crops.

Most of this soil is in pasture. Where tile drains or other types of drainage have been established, corn and soybeans are the main crops. The vegetation provides habitat for most kinds of local wildlife. (Capability unit IIw-4; Subirrigated range site; Moderately Wet windbreak suitability group)

Colo silty clay loam, drained (0 to 1 percent slopes) (Cb).—This moderately well drained soil formed in silty alluvium on bottom lands. It has a slightly higher elevation than surrounding soils or is near an entrenched channel that improves drainage. Its profile is similar to the one described as representative for the Colo series, but mottling is less evident in the lower layers. Included with this soil in mapping were small areas that have 6 to 8 inches of silt loam overwash on the surface.

The water table in this Colo soil is at a depth of 8 to 12 feet. Occasional flooding and slow surface drainage are the major hazards. In some places, erosion of the streambanks is a concern.

Nearly all the acreage of this soil is cultivated. The principal crops are corn and soybeans. This soil responds favorably to irrigation. Trees grow well, and the vegetation provides food and shelter for wildlife. (Capability unit I-1; Silty Lowland range site; Silty to Clayey windbreak suitability group)

Colo and Lamo silty clay loams (0 to 1 percent slopes) (Cc).—The soils in this undifferentiated group are along drainageways on wide bottom lands. Areas of these soils range from 60 to 90 acres in size. Most contain both soils in proportions that range widely from place to place, but some consist entirely of either Colo silty clay loam or Lamo silty clay loam. The profile of each soil is similar to the one described as representative of its respective series. Included with these soils in mapping were areas having 1 to 8 inches of silt loam overwash on the surface.

The water table is at a depth of 2 to 8 feet. Runoff is slow. Sometimes excessive wetness delays seeding and cultivation.

About half the acreage of these soils is in pasture, which is predominantly bluegrass and white clover. Corn and soybeans are the principal row crops. These soils are especially well suited to wildlife, as streambanks and irregular areas produce an abundance of food and cover. (Capability unit IIw-4; Subirrigated range site; Moderately Wet windbreak suitability group.)

Crofton Series

The Crofton series consists of deep, calcareous, well-drained soils on uplands. These immature, gently sloping to moderately steep soils formed in loess. They are mainly on ridgetops and convex sides of hills.

In a representative profile, the surface layer is grayish-brown silt loam about 7 inches thick. Beneath this is a transition layer consisting of grayish-brown, calcareous silt loam about 5 inches thick. Both of these layers contain many lime concretions. The underlying material is calcareous silt loam that is brown to a depth of 17 inches, light brownish gray between depths of 17 and 25 inches, and pale brown below a depth of 25 inches.

Crofton soils have moderate permeability, high available water capacity, and moderately low organic-matter content. They are low in nitrogen and available phosphorus. Soil reaction is moderately alkaline throughout the profile.

These soils are well suited to grasses for pasture or range. Where the slopes are not too steep, they are suited to cultivated crops. Trees grow well, and the vegetation provides habitat for wildlife.

Representative profile of Crofton silt loam, 7 to 11 percent slopes, eroded, in a cultivated field, 1,470 feet south and 150 feet east of the northwest corner of sec. 2, T. 25 N., R. 1 E.:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, very fine, granular structure; soft, very friable; many lime concretions; violent effervescence; moderately alkaline; abrupt, smooth boundary.

AC—7 to 12 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky structure; slightly hard, friable; many large lime concretions; many lime threads; thin shiny coatings on vertical faces of peds; violent

effervescence; moderately alkaline; clear, wavy boundary.

C1—12 to 17 inches, brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; weak, coarse, prismatic structure parting to massive; slightly hard, friable; many lime concretions; few lime threads; violent effervescence; moderately alkaline; clear, wavy boundary.

C2—17 to 25 inches, light brownish-gray (10YR 6/2) silt loam, mixed gray (10YR 5/1) and yellowish brown (10YR 5/6) moist; massive; soft, very friable; common lime concretions; few lime threads; violent effervescence; moderately alkaline; clear, wavy boundary.

C3—25 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; common, fine, distinct. yellowish-red (5YR 5/6) mottles; massive; soft, very friable; few lime concretions; violent effervescence; moderately alkaline.

The Ap horizon ranges from 5 to 10 inches in thickness and is grayish brown to brown in color. It has a wide range in the number and size of lime concretions. The AC horizon ranges from 5 to 12 inches in thickness and is grayish brown to pale brown in color. In some places the AC horizon is absent.

Crofton soils are associated with Nora soils. They have a thinner A horizon than Nora soils and do not have a B horizon.

Crofton silt loam, 2 to 7 percent slopes, eroded (CfC2).—This soil is in long, narrow areas on convex ridgetops. Numerous white lime concretions occur on the surface. The profile of this soil is similar to the one described as representative of the Crofton series. Included in mapping were small areas of Nora soils on wide ridgetops.

This Crofton silt loam has moderately low organic-matter content and is low in nitrogen and available phosphorus. Runoff is medium, and severe erosion by water is the principal hazard.

Most areas of this soil are cultivated, but a small acreage is used for tame pasture. Alfalfa, oats, corn, and grain sorghum are the principal crops. This soil is not well suited to soybeans. (Capability unit IIIe–9; Limy Upland range site; Silty to Clayey windbreak suitability group)

Crofton silt loam, 7 to 11 percent slopes, eroded (CfD2).—This soil has convex slopes. Numerous white lime concretions occur on the surface. The profile of this soil is the one described as representative of the Crofton series. Included in mapping were small areas of Nora silt loam, 7 to 11 percent slopes, eroded; these areas make up about 20 percent of the mapped unit.

This Crofton silt loam has moderately low organic-matter content and is low in nitrogen and available phosphorus. The intake of rainfall is slow on these slopes, and runoff is rapid. Small gullies are present in most areas, but these generally can be plowed and seeded to crops or grasses. Where this soil is cultivated, erosion by water is the principal hazard. Maintaining good tilth is a concern.

About one-half of the acreage of this soil is cultivated, and the rest is in pasture or hay. Adding phosphorus to the soil is beneficial to alfalfa. This soil is not well suited to soybeans. (Capability unit IVe–9; Limy Upland range site; Silty to Clayey windbreak suitability group)

Crofton silt loam, 11 to 20 percent slopes, eroded (CfE2).—This soil is on some of the steepest convex slopes in the county. Numerous white lime concretions occur on the surface. The profile of this soil is similar to the one described as representative of the Crofton series, except that the surface layer is slightly darker and thicker in a few places. Included in mapping were some areas of more steeply sloping soils along drains and gullies. Included also were small areas of Nora soils.

This Crofton silt loam has moderately low organic-matter content and is low in nitrogen and available phosphorus. Runoff is rapid and difficult to control. Deep gullies are common. Where this soil is cultivated, erosion by water is a severe hazard.

This soil is better suited to grasses for pasture and hay than to cultivated crops. Most areas are too steep for cultivation, but some crops are grown. Some areas are in native range, and small areas are in native woodland. The vegetation provides habitat for wildlife. (Capability unit VIe–9; Limy Upland range site; Silty to Clayey windbreak suitability group)

Fillmore Series

The Fillmore series consists of deep, poorly drained soils that formed in depressions on the uplands. These depressions receive runoff from surrounding soils.

In a representative profile, the surface layer is dark-gray silt loam about 12 inches thick. The subsurface layer is very friable, gray silt loam about 14 inches thick. The subsoil is very hard, firm, mottled silty clay; the upper 10 inches is mixed dark gray and gray, and the lower part is mixed gray and light olive gray to depths below 60 inches.

Fillmore soils have very slow permeability, high available water capacity, and high organic-matter content. Moisture is released slowly to plants. Soil reaction is slightly acid in the plow layer, neutral in the subsurface layer and upper part of the subsoil, and mildly alkaline in the lower part of the subsoil.

These soils are well suited to tame grass for pasture and hay and moderately well suited to cultivated crops. Trees adapted to wet soils grow well. Areas of Fillmore soils are especially well suited to wetland wildlife and to hunting and other recreational uses.

Representative profile of Fillmore silt loam in an area of Fillmore complex, in tame hayland, 2,100 feet east and 100 feet south of the northwest corner of sec. 30, T. 26 N., R. 5 E.:

Ap—0 to 5 inches, dark-gray (10YR 4/1) heavy silt loam, black (10YR 2/1) moist; weak, very fine, granular structure; slightly hard, friable; slightly acid; abrupt, smooth boundary.

A12—5 to 12 inches, dark-gray (10YR 4/1) heavy silt loam, black (N 2/0) moist; moderate, medium, subangular blocky structure; hard, firm; neutral; abrupt, smooth boundary.

A2—12 to 26 inches, gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak, thin, platy structure parting to weak, very fine, granular structure; soft, very friable; neutral; gradual, wavy boundary.

B21t—26 to 36 inches, mixed dark-gray (5Y 4/1) and gray (5Y 6/1) silty clay, mixed black (5Y 2/1) and very dark gray (5Y 3/1) moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, very fine, granular structure parting to massive; very hard, firm; A2 material tongued into this horizon; shiny surfaces on faces of peds; common, dark reddish-brown segregations; neutral; gradual, wavy boundary.

B22t—36 to 60 inches, mixed gray (5Y 5/1) and light olive-gray (5Y 6/2) silty clay, mixed black (5Y 2/1) and dark gray (5Y 4/1) moist; many, coarse, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, firm; shiny surfaces on faces of peds; common, dark reddish-brown segregations; mildly alkaline.

The A horizon is silt loam or silty clay loam and ranges from 6 to 14 inches in thickness. Generally the A2 horizon is about 10 inches thick, but in some places it is lacking and in some

other places is as much as 14 inches thick. The B horizon ranges from heavy silty clay loam to silty clay and has strong-brown to reddish-brown mottles. The B21t horizon ranges from dark gray to light gray in color and is of 5Y and 2.5Y hue. It is neutral to slightly acid in reaction. The B22t horizon ranges from gray to light olive gray in color and is of 5Y and 2.5Y hue.

Fillmore soils are associated with Belfore soils. They are more poorly drained than Belfore soils, occur in relatively lower elevations, and have an A2 horizon that is not in Belfore soils.

Fillmore complex (0 to 1 percent slopes) (Fm).—Soils in this complex are in depressions on upland divides. Most areas of the complex are 2 to 7 acres in size; a small spot symbol is used on the soil map to indicate areas of less than 2 acres. The complex includes Fillmore soils that have surface layers either of silt loam or of silty clay loam.

Included with these soils in mapping were some areas that are ponded for long periods of time. Also included were small areas of soils that lack the gray subsurface horizon.

Fillmore soils are difficult to work. They are slightly deficient in lime in the surface layer. In periods of high rainfall, runoff is ponded on these soils and crops are drowned. Excess water commonly delays cultivation and makes control of weeds difficult. Some areas have been drained. Most crops grow well on these soils, particularly where surface drainage is provided.

About 50 percent of the acreage of these soils is cultivated. Some areas are used to grow tame grass for pasture or hay, and some are idle. Corn and soybeans are the principal row crops, and red clover is the main hay crop. (Capability unit IIIw-2; Clayey Overflow range site; Moderately Wet windbreak suitability group)

Hadar Series

The Hadar series consists of deep, well-drained soils on the uplands. These soils formed in windblown sand that was deposited on calcareous clay loam till. They are moderately sloping to moderately steep and have concave slopes.

In a representative profile, the surface layer is loamy fine sand about 16 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. The subsoil, about 34 inches thick, is very friable, brown loamy fine sand in the upper part; friable, brown loam in the middle part; and firm, light yellowish-brown clay loam in the lower part. The underlying material, to a depth of 60 inches, is mixed light-gray and very pale brown, calcareous clay loam till.

Hadar soils have rapid permeability in the upper part of the profile and moderately slow permeability in the lower part. The available water capacity is moderate, and organic-matter content is moderately low. Moisture is released readily to plants.

These soils are well suited to grasses for range. Most areas are too steep for cultivation. Trees grow well, and the vegetation provides habitat for wildlife.

Representative profile of Hadar loamy fine sand in an area of Hadar-Thurman complex, 5 to 15 percent slopes, in range, 400 feet south and 140 feet east of the northwest corner of sec. 19, T. 25 N., R. 1 E.:

A11—0 to 8 inches, dark-gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak, fine, crumb structure; soft, very friable; slightly acid; gradual, wavy boundary.

A12—8 to 16 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak, fine, crumb structure; soft, very friable; neutral; gradual, wavy boundary.

B1—16 to 23 inches, brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak, coarse, subangular blocky structure parting to single grained; soft, very friable; neutral; clear, smooth boundary.

IIB21—23 to 28 inches, brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak, medium, subangular blocky structure; slightly hard, friable; neutral; clear, wavy boundary.

IIB22—28 to 50 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate, fine, prismatic structure parting to moderate, medium, subangular blocky structure; very hard, firm; shiny, brown (10YR 5/3) surfaces on vertical faces of peds; few small pebbles; neutral; clear, wavy boundary.

IIC—50 to 60 inches, mixed light-gray (10YR 7/2) and very pale brown (10YR 7/4) clay loam, gray (10YR 6/1) and light yellowish brown (10YR 6/4) moist; weak, coarse, subangular blocky structure; very hard, firm; many lime concretions; few large pockets of soft lime; few small pebbles; violent effervescence; moderately alkaline.

The A horizon ranges from 6 to 16 inches in thickness and is gray to dark grayish brown in color. The B1 horizon is loamy fine sand or fine sandy loam. The IIB2 horizon is clay loam or loam. The IIC horizon is mixed light gray to light yellowish brown.

Hadar soils are associated with Thurman soils. They are finer textured in the lower part of the profile than Thurman soils and have lime nearer the surface.

Hadar-Thurman complex, 5 to 15 percent slopes (HtE).—Soils in this mapping unit are on the uplands. Hadar loamy fine sand is in the middle elevations of the landscape and makes up about 40 percent of the complex. Thurman loamy fine sand, which is on lower elevations and along drainageways, makes up about 35 percent of the complex. Soils formed in glacial material on the highest knobs and hills make up the remaining 25 percent.

The Hadar and Thurman soils have profiles similar to the ones described as representative of their respective series. The surface layer of the glacial soils is dark-gray gravelly loam about 11 inches thick. The underlying material is brown to yellowish-brown, firm clay interspersed with pebbles, stones, and a few large, soft lime pockets. Included with these soils in mapping were small areas that have a loamy fine sand surface layer that is less than 12 inches thick over the underlying till and a few areas that have a sandy clay loam surface layer.

Runoff is rapid on the higher parts of the landscape and medium on the lower parts. Erosion by water is common, particularly on the steeper soils. Many stones are on the higher knobs and hills. Where the soils are cultivated, soil blowing is a serious hazard.

The soils in this complex are used almost entirely for range. (Capability unit IVe-5; Sands range site; Sandy windbreak suitability group)

Judson Series

The Judson series consists of gently sloping, deep, well-drained soils on colluvial foot slopes at the bases of upland slopes.

In a representative profile, the upper 16 inches of the surface layer is dark-gray silt loam and the lower 13 inches is gray silty clay loam. The upper 6 inches of the subsoil is dark grayish-brown, friable silty clay loam, and the

lower part is brown, firm silty clay loam to a depth of 60 inches.

Judson soils have moderate permeability, high available water capacity, and high organic-matter content. They release moisture readily to plants. Soil reaction is neutral throughout the profile.

These soils are suited to all locally grown crops and to grass and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Judson silt loam, 2 to 7 percent slopes, in a cultivated field, 940 feet east and 110 feet north of the southwest corner of sec. 35, T. 26 N., R. 4 E.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate, fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A12—6 to 16 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate, very fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A13—16 to 29 inches, gray (10YR 5/1) silty clay loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, friable; neutral; gradual, wavy boundary.

B21—29 to 35 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable; neutral; gradual, wavy boundary.

B22—35 to 60 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky structure; hard, firm; neutral.

The A horizon ranges from 25 to 35 inches in thickness and from very dark gray to gray in color. The B horizon is dark grayish brown to brown. In places organic stains are on structure faces in the B horizon.

Judson soils are associated with Moody, Kennebec, and Colo soils. They have a thicker A horizon and less distinct horizons than Moody soils. They are finer textured in the lower part of the profile than Kennebec soils. The B horizon that is present in Judson soils is lacking in Kennebec and Colo soils.

Judson silt loam, 2 to 7 percent slopes (JuC).—This soil is on stream terraces and concave foot slopes at the base of upland slopes. Included in mapping were soils that have a thinner surface layer and a lighter colored subsoil than this soil.

Erosion by water is the principal hazard on this soil. During hard rains, gullies commonly are formed by runoff as it moves across the area to drainageways. These gullies are shallow and do not interfere seriously with cultivation. Small areas lack surface drainage.

Nearly all the acreage of this soil is cultivated, but small areas have been seeded to tame grass for pasture. Corn, soybeans, and alfalfa are the principal crops. Small areas near farmsteads commonly are used for garden crops. (Capability unit IIe-1; Silty range site; Silty to Clayey windbreak suitability group)

Kennebec Series

The Kennebec series consists of deep, moderately well drained, friable, nearly level soils that formed in silty alluvium on bottom lands.

In a representative profile, the surface layer is silt loam about 29 inches thick. It is dark gray to a depth of 25 inches and mixed dark gray and light brownish gray in the remaining 4 inches. A former surface layer beneath this is very dark gray silt loam to a depth of 36 inches and dark-gray silt loam to a depth of 49 inches. The underlying transition layer is dark-gray, mottled silt loam to a depth of 60 inches.

Kennebec soils have moderate permeability, high available water capacity, and high organic-matter content. They release moisture readily to plants. Soil reaction is neutral throughout the profile.

Kennebec soils are well suited to cultivated crops, grass, and trees. They provide good habitat for wildlife and can be used for recreation.

Representative profile of Kennebec silt loam in a cultivated field, 528 feet north and 100 feet west of the southeast corner of sec. 6, T. 26 N., R. 3 E.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, friable; neutral; abrupt, smooth boundary.

A12—6 to 16 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure parting to moderate, very fine, granular structure; soft, friable; neutral; clear, wavy boundary.

A13—16 to 25 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure parting to moderate, very fine, granular structure; slightly hard, friable; neutral; clear, wavy boundary.

A14—25 to 29 inches, mixed dark-gray (10YR 4/1) and light brownish-gray (10YR 6/2) silt loam, very dark brown (10YR 2/2) and grayish brown (10YR 5/2) moist; moderate, medium, granular structure; slightly hard, friable; neutral; clear, wavy boundary.

A15b—29 to 36 inches, very dark gray (10YR 3/1) heavy silt loam, black (10YR 2/1) moist; moderate, medium, granular structure; slightly hard, friable; neutral; clear, wavy boundary.

A16b—36 to 49 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak, coarse, subangular blocky structure parting to moderate, very fine, granular structure; slightly hard, friable; neutral; clear, wavy boundary.

ACb—49 to 60 inches, dark-gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) moist; few, fine, faint, yellowish-red (5YR 5/6) mottles; weak, fine, prismatic structure parting to moderate, fine, subangular blocky structure; slightly hard, friable; neutral.

The A horizon ranges from dark grayish brown to very dark gray in color and from 24 to 50 inches in thickness. The Ab horizon is absent in some places. The ACb horizon is mainly dark gray ranging to brown. It is silt loam or light silty clay loam and has yellowish-red to reddish-brown mottles.

Kennebec soils are associated with Colo and Lamo soils. They are not so fine textured and are better drained than Colo and Lamo soils. Lime is at a greater depth than in Lamo soils.

Kennebec silt loam (0 to 1 percent slopes) (Ke).—This soil is on bottom lands of wide, deeply entrenched valleys. In about 20 percent of the acreage of this soil, the lower part of the surface layer has a stronger granular structure than described in this part of the representative profile. In some places, particularly in the western part of the county, this lower part of the surface layer is brown. Included in mapping were soils that have a thinner surface layer than the one described in the profile. Also included were areas that have about 8 inches of light-colored overwash on the surface.

Runoff is slow. Occasional flooding is a hazard, and some slight channeling occurs. During periods of heavy rainfall, silty soil material is deposited on the surface, but this sediment seldom damages the crops.

Kennebec silt loam is one of the best soils in Wayne County for growing crops. Most of the acreage is planted to

corn. Small areas along creeks commonly are in grass or trees. This vegetation provides good habitat for wildlife. (Capability unit I-1; Silty Lowland range site; Silty to Clayey windbreak suitability group)

Lamo Series

The Lamo series consists of deep, somewhat poorly drained, nearly level soils. They formed in calcareous silty alluvium on bottom lands. The water table is at a depth of 2 to 10 feet.

In a representative profile, the surface layer is silty clay loam about 28 inches thick. It is dark gray in the upper part and black in the lower part. The transition layer beneath this is dark-gray silty clay loam 5 inches thick. The underlying material is silty clay loam. The upper part is a layer where lime accumulated. It is gray and has reddish-brown mottles. The lower part has a few small lime concretions and is dark gray and calcareous.

Lamo soils have moderately slow permeability, high available water capacity, and high organic-matter content. They release moisture readily to plants. These soils are mildly alkaline in the surface layer, moderately alkaline in the transition layer and in the layer having high content of lime, and mildly alkaline in the lower part of the underlying material.

Where adequately drained, these soils are well suited to cultivated crops. Grass and trees grow well and provide habitat for wildlife.

Representative profile of Lamo silty clay loam in a cultivated field, 1,584 feet north and 87 feet west of the southeast corner of sec. 9, T. 26 N., R. 3 E.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure parting to weak, very fine, granular structure; soft, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

A12—6 to 28 inches, black (10YR 2/1) silty clay loam, black (10YR 2/1) moist; moderate, very fine, subangular blocky structure parting to moderate, fine, granular structure; soft, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

AC—28 to 33 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, very fine, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, friable; slight effervescence, 6 percent calcium carbonate; moderately alkaline; clear, wavy boundary.

Cca—33 to 43 inches, gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; few, fine, faint, reddish-brown (5YR 5/4) mottles; moderate, very fine, subangular blocky structure parting to moderate, fine, granular structure; slightly hard, friable; violent effervescence, 7 percent calcium carbonate; common small lime concretions; moderately alkaline; gradual, smooth boundary.

Cg—43 to 60 inches, dark-gray (2.5Y 4/1) silty clay loam, very dark gray (2.5Y 3/1) moist; moderate, very fine, prismatic structure parting to moderate, fine, subangular blocky structure; very hard, firm; few small lime concretions; slight effervescence; mildly alkaline.

The A horizon ranges from 13 to 36 inches in thickness, from silty clay loam to silt loam in texture, and from black to dark grayish brown in color. The AC horizon is from 4 to 12 inches thick. The Cca horizon ranges from 6 to 15 inches in thickness and is dark gray or gray. The Cg horizon has very dark brown or black shotlike segregations and is stratified in places. Texture in this horizon ranges from silty clay loam to silt loam and dominant colors from very dark gray to light brownish gray. Few to numerous lime concretions occur throughout the profile, and calcium carbonate content ranges from 6 to 12 percent.

Lamo soils are associated with Colo and Kennebec soils. They are finer textured and have a water table nearer the surface than Kennebec soils. They have calcium carbonate nearer the surface than Colo soils.

Lamo silt loam, occasionally flooded (0 to 1 percent slopes) (La).—This soil is on narrow bottom lands of upland drainageways and occurs most commonly where the narrow valleys merge with broader valleys. Most areas range from 5 to 20 acres in size. This soil has a profile similar to the one described as representative of the Lamo series except that the surface layer is 8 to 20 inches of gray overwash soil material.

Included with this soil in mapping were soils that have a slightly thicker or slightly thinner surface layer. Also included were small areas of soils that have a silty clay loam surface layer and some that have a water table below a depth of 10 feet.

Runoff is slow, and flooding occurs in about 3 out of 5 years. This flooding causes some deposition of light-colored silty material on the surface of the soil and can cause some damage to crops if the plants are small. Tillage and planting commonly are delayed by wetness.

Most of the acreage of this soil is used for tame pasture but some areas are used for cropland. The principal crops are corn and soybeans. This soil is not well suited to oats. (Capability unit IIw-4; Subirrigated range site; Moderately Wet windbreak suitability group)

Lamo silty clay loam (0 to 1 percent slopes) (Lb).—This soil is on bottom lands of large valleys. It occurs in areas that generally are less than 80 acres in size. Its profile is the one described as representative of the Lamo series. Included with this soil in mapping were areas along narrow bottom lands where the soil is silt loam throughout its profile, areas along Logan Creek just east of the town of Wayne where the soil is silty clay throughout its profile, and small areas where the upper 20 inches of the soil is noncalcareous. Also included were some areas of Kennebec and Judson soils on slightly raised elevations.

The depth to the water table is 2 to 10 feet. In many places, tile drains have improved the internal drainage and lowered the water table. Occasional flooding is a hazard along creeks. Tillage and planting often are delayed because the soil is slow to warm up and dry out in spring.

Nearly all of the acreage of this soil is cultivated. Corn and soybeans are the principal crops. Areas that are subject to flooding or that have a high water table generally are used for pasture. Small, odd-shaped areas along creeks provide excellent habitat for wildlife. (Capability unit IIw-4; Subirrigated range site; Moderately wet windbreak suitability group)

Loretto Series

The Loretto series consists of deep, nearly level to gently sloping, well-drained soils on uplands. These soils formed in loamy soil material that was deposited by wind over silty soil material.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 11 inches thick. The subsoil is brown, friable silty clay loam in the upper 4 inches; yellowish-brown friable silty clay loam in the middle 3 inches; and light brownish-gray, friable silt loam in the lower 10 inches. The underlying material is silt loam that is light brownish gray to a depth of 37 inches and mixed light gray and light yellowish brown between depths of

37 and 60 inches. Yellowish-brown mottles occur throughout the profile below a depth of 18 inches, and accumulated lime occurs between depths of 18 and 37 inches.

Loretto soils have moderate permeability, high available water capacity, and moderate organic-matter content. They readily release moisture to plants. Soil reaction is neutral in the upper part of the surface layer, mildly alkaline in the rest of the surface layer and in the upper part of the subsoil, and moderately alkaline below a depth of about 18 inches.

Loretto soils are suited to cultivated crops, grass, and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Loretto fine sandy loam, 0 to 2 percent slopes, in a cultivated field, 1,440 feet south and 245 feet west of the northeast corner of sec. 31, T. 25 N., R. 1 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky structure parting to single grained; soft, very friable; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; coarse, subangular blocky structure parting to single grained; soft, very friable; mildly alkaline; abrupt, smooth boundary.

IIB21—11 to 15 inches, brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure parting to moderate, coarse, subangular blocky structure; hard, friable; neutral; clear, wavy boundary.

IIB22—15 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam, brown (10YR 4/3) moist; moderate, coarse, prismatic structure parting to moderate, coarse, subangular blocky structure; hard, friable; mildly alkaline; clear, wavy boundary.

IIB3ca—18 to 28 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; clear, wavy boundary.

IIC1ca—28 to 37 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; many, coarse, distinct, yellowish-brown (10YR 5/4) mottles; massive; soft ,very friable; large lime concretions; violent effervescence; moderately alkaline; clear, wavy boundary.

IIC2—37 to 60 inches, mixed light-gray (10YR 7/2) and light yellowish-brown (10YR 6/4) silt loam, light brownish gray (10YR 6/2) moist; many, coarse, distinct yellowish-brown (10YR 5/4) mottles; massive; soft, very friable; violent effervescence; moderately alkaline.

The A horizon ranges from 8 to 22 inches in thickness and is grayish brown to dark gray in color. The B horizon is from 12 to 36 inches thick. It most commonly is silty clay loam in the upper part and silt loam in the lower part, but in some places is fine sandy loam in the upper part. A Ca layer occurs in some areas as part of the upper C horizon.

Loretto soils are associated with Ortello, Nora, and Moody soils. They have a finer textured B horizon than Ortello soils and a thicker, coarser textured A horizon than Nora or Moody soils.

Loretto fine sandy loam, 0 to 2 percent slopes (LvA).—This soil is on a stream terrace of Logan Creek in large areas that range from about 60 to 80 acres in size. In severely eroded areas, some subsoil generally is mixed with the surface layer.

Included with this soil in mapping were small areas of soils that have a thicker subsoil than the one in the representative profile and some that have lime at a greater depth. Also included were a few small areas of Ortello soils.

Runoff is slow. Where this soil is cultivated, soil blowing is the principal hazard and maintaining organic-matter content and fertility are concerns.

Nearly all the acreage of this soil is cultivated. Corn is the principal crop. Alfalfa is grown as part of the normal crop sequence. (Capability unit IIe-3; Sandy range site; Sandy windbreak suitability group)

McPaul Series

The McPaul series consists of deep, nearly level, moderately well drained soils that formed in silty alluvium on bottom lands.

In a representative profile, the surface layer is calcareous silt loam that is brown in the upper 8 inches and grayish brown in the lower 5 inches. The underlying material is silt loam about 36 inches thick. It is stratified dark grayish brown and light grayish brown in the upper part, stratified dark brown and grayish brown in the middle part, and stratified dark gray and light brownish gray with prominent dark reddish-brown mottling in the lower part. A buried surface layer of very dark gray silt loam is at a depth of 49 inches.

McPaul soils have moderate permeability, high available water capacity, and high organic-matter content. They absorb moisture easily and release it readily to plants. Soil reaction is moderately alkaline in the surface layer and mildly alkaline throughout the remainder of the profile.

McPaul soils are suited to cultivated crops, grass, and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of McPaul silt loam, in a cultivated field, 500 feet south and 190 feet west of the northeast corner of sec. 13, T. 26 N., R. 4 E.:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak, very thin, platy structure; soft, very friable; slight effervescence; moderately alkaline; abrupt, smooth boundary.

A12—8 to 13 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, very thin, platy structure parting to weak, very fine, granular structure; soft, friable; slight effervescence; moderately alkaline; abrupt, smooth boundary.

C1—13 to 16 inches, stratified dark grayish-brown (10YR 4/2) and light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) moist; weak, medium, angular blocky structure; compacted; slightly hard, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

C2—16 to 36 inches, stratified dark-brown (10YR 3/3) and grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) moist; weak, very thin, platy structure parting to weak, very fine, granular structure; slightly hard, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

C3—36 to 49 inches, stratified dark-gray (10YR 4/1) and light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) moist; common, fine, prominent, dark reddish-brown (5YR 3/3) mottles; weak, fine, platy structure parting to weak, very fine, granular structure; slightly hard, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

Ab—49 to 60 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak, very fine, granular

structure; slightly hard, friable; slight effervescence; mildly alkaline.

The A horizon is brown to dark gray and is from 10 to 18 inches thick. The C horizon ranges from silt loam to light silty clay loam in texture and from dark gray to very dark grayish brown in color. An Ab horizon is common below a depth of 30 inches. It ranges from silt loam to light silty clay loam in texture and from very dark gray to gray in color. In some places the soil is highly stratified with alternating light- and dark-colored strata of silt loam.

McPaul soils are associated with Kennebec, Lamo, and Colo soils. They are lighter colored and more stratified than Kennebec soils and not so fine textured as Lamo or Colo soils.

McPaul silt loam (0 to 1 percent slopes) (Mc).—This soil is mainly on narrow bottom lands of upland drainageways. It is also at the edge of wide bottom lands, where it receives runoff from adjacent soils at higher elevations. Its profile is the one described as representative of the McPaul series. In a few areas the water table is at a depth of 4 to 6 feet. Included with this soil in mapping were small areas of soils that have slopes of about 2 percent. Also included were small areas of Judson soils and of Kennebec silt loam.

Runoff is slow. Flooding during periods of high rainfall, especially late in spring and early in summer, is a serious hazard and often delays planting and tillage. Some channeling occurs in areas adjacent to drains.

Most of the acreage of this soil is cultivated. Corn and soybeans are the principal crops. This soil is not well suited to oats. In areas where flooding is severe, tame grass is the main crop. (Capability unit IIw-3; Silty Overflow range site; Moderately Wet windbreak suitability group)

McPaul silt loam, wet (0 to 1 percent slopes) (Md).—This is a somewhat poorly drained soil on long, narrow bottom lands that receive runoff from adjacent soils at higher elevations. Its profile is similar to the one described as representative of the McPaul series except that mottling is more prominent, and the water table is at a depth of 2 to 10 feet. Included with this soil in mapping were small areas of McPaul silt loam (Mc) and small areas of the occasionally flooded Colo silt loam.

Runoff is slow. Springs are common in this soil. Flood damage and siltation occur during the early part of the growing season in some years. Wetness caused by the moderately high water table commonly delays tillage and planting. Tile drains have improved the internal drainage of some areas.

Most of the acreage of this soil is in pasture or hay. Small acreages are in corn, soybeans, or alfalfa. Native trees are common along the natural drainageways. These areas provide excellent habitat for wildlife and can be used for recreation, particularly hunting. (Capability unit IIw-4; Subirrigated range site; Moderately Wet windbreak suitability group)

Moody Series

The Moody series consists of deep, gently sloping to moderately steep, well-drained soils that formed in thick deposits of loess on uplands. Most of these soils are on broad divides or on concave hillsides that have mainly east- and north-facing slopes. In a few places Moody soils border intermittent drainageways.

In a representative profile (fig. 5), the surface layer is dark grayish-brown silty clay loam about 11 inches

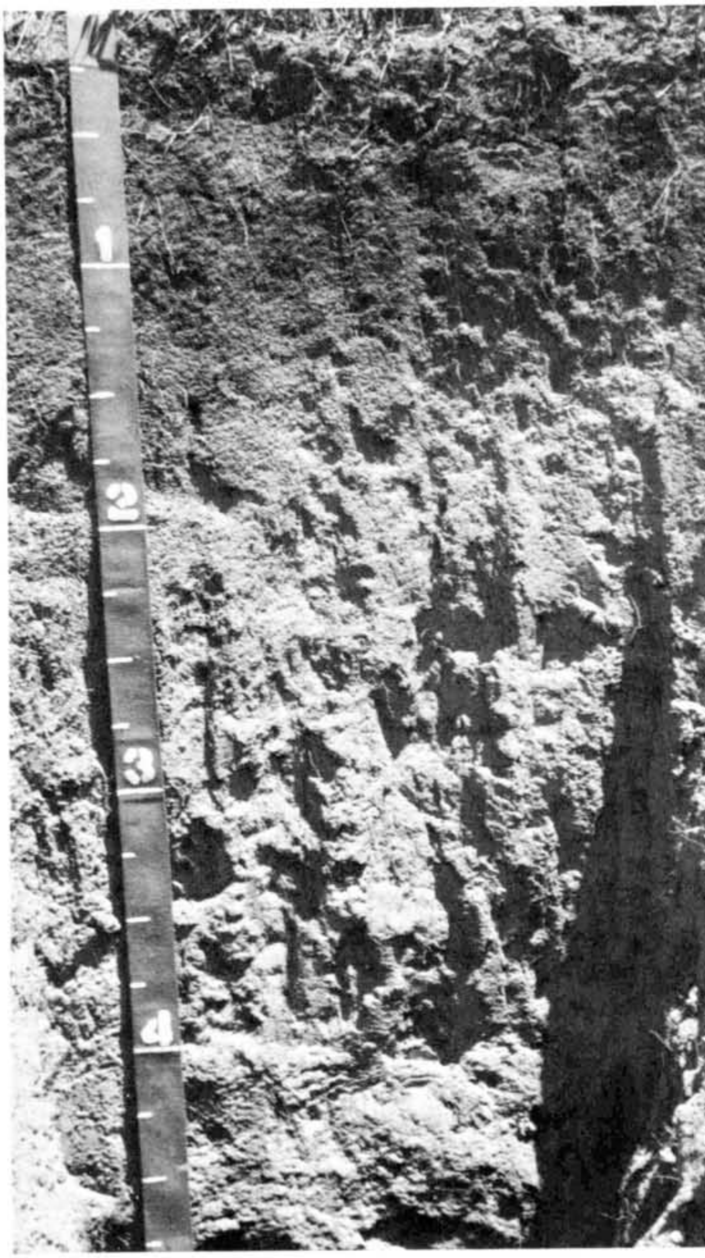

Figure 5.—**Profile of a Moody silty clay loam, a deep soil easily penetrated by roots.**

thick. The subsoil is friable, brown silty clay loam about 31 inches thick. The underlying material, at a depth of 42 inches, is light yellowish-brown silt loam that has gray mottles.

Moody soils have moderately slow permeability, high available water capacity, and moderate organic-matter content. They release moisture readily to plants. The surface layer and subsoil are neutral in reaction, and the underlying material is mildly alkaline.

Moody soils are suited to cultivated crops, trees, and grass. They also provide habitat for wildlife and can be used for recreation.

Representative profile of Moody silty clay loam, 2 to 7 percent slopes, in a cultivated field, 0.35 mile south and 65

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feet east of the northwest corner of sec. 25, T. 26 N., R. 2 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—7 to 11 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; slightly hard, friable; neutral; clear, wavy boundary.

B21—11 to 26 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky structure; hard, friable; shiny sides on vertical faces of peds; neutral; clear, wavy boundary.

B22—26 to 42 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky structure; hard, friable; shiny sides on vertical faces of peds; neutral; clear, wavy boundary.

C—42 to 60 inches, light yellowish-brown (10YR 6/4) silt loam, brown (10YR 4/3) moist; common, fine, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; slightly hard, friable; common dark reddish-brown segregations; common fine pores; mildly alkaline.

The A horizon most commonly ranges from silty clay loam to silt loam but in a few areas is fine sandy loam. It ranges from 7 to 15 inches in thickness and from dark gray to dark grayish brown in color. Where cultivation has mixed the A and B horizons, the A horizon is brown or dark brown. Some profiles have an A3 horizon, which is from 2 to 12 inches thick. The B horizon ranges from 26 to 48 inches in thickness. Some profiles have a B3 horizon that is silt loam or light silty clay loam. The lower part of the B horizon commonly is calcareous. The C horizon is pale brown to light yellowish brown and has mottles of gray or reddish brown. In some profiles a layer where lime has accumulated is in the upper part of the C horizon at a depth of 36 to 60 inches.

Moody soils are associated with Nora, Belfore, Crofton, and Loretto soils. They have a thicker, more clayey B horizon than Nora soils and a thinner, less clayey B horizon than Belfore soils. They have a thicker, darker A horizon than Crofton soils, which do not have a B horizon, and the depth to lime is greater. Moody soils are more silty in the upper part of the profile than Loretto soils.

Moody silt loam, 2 to 7 percent slopes (MhC).—This soil occurs in wide, irregularly shaped areas on broad uplands and also on ridgetops that separate upland drainageways. Its profile is similar to the one described as representative of the Moody series, but the surface layer is silt loam. Included with this soil in mapping were a few small areas of Ortello and Loretto soils.

Runoff is medium. This Moody silt loam is easily worked. Erosion by water is a slight hazard. Where the surface layer is not adequately protected, soil blowing also is a hazard.

Most of the acreage of this soil is cultivated. Corn, oats, and alfalfa are the principal crops. Grain sorghum also is grown, and small acreages are used for pasture. (Capability unit IIe-1; Silty range site; Silty to Clayey windbreak suitability group)

Moody silty clay loam, 2 to 7 percent slopes (MoC).—This soil is on broad divides and ridgetops of the uplands. Its profile is the one described as representative of the Moody series.

Included with this soil in mapping were some eroded soils that have a thinner and lighter colored surface layer than that described in the profile. In these areas, tillage has mixed the upper subsoil with the surface layer. Also included in mapping were small areas of Nora soils on narrow ridgetops, small areas of the nearly level Belfore soils, and some Fillmore soils in small depressions. The larger areas of the Fillmore soils are shown on the detailed map by a special symbol.

Runoff is medium. Erosion is a slight hazard.

Most of the acreage is planted to corn and soybeans. All the locally grown crops are well suited to this soil. (Capability unit IIe-1; Silty range site; Silty to Clayey windbreak suitability group)

Moody silty clay loam, 7 to 11 percent slopes (MoD).—This soil is in concave areas on sides of hills. In a few places these areas border intermittent drainageways. The profile is similar to the one described as representative of the Moody series, but the surface layer is thinner, and tillage has mixed the darker surface layer with the subsoil in some areas. Included with this soil in mapping were small areas of Judson soils along drainageways and small areas of Nora soils on ridgetops.

Runoff is medium. This Moody soil is easily worked. In cultivated areas, erosion by water causes small rills and gullies but these generally can be leveled by plowing and tillage. During hard rains, runoff forms small gullies along the drainageways.

Most of the acreage of this soil is cultivated. Corn, soybeans, oats, and alfalfa are the principal crops. Grain sorghum also is grown and small acreages have been reseeded to tame grass. (Capability unit IIIe-1; Silty range site; Silty to Clayey windbreak suitability group)

Moody silty clay loam, 7 to 11 percent slopes, eroded (MoD2).—This soil has long slopes on hillsides in the loess uplands. The soil areas are larger than most soil areas on the uplands. Its profile is similar to the one described as representative of the Moody series except that the surface layer is about 5 to 7 inches thick and the subsoil is also thinner. This soil is lighter colored than the uneroded Moody soils. Tillage has mixed some of the subsoil with the surface layer. Included with this soil in mapping were small areas of Nora soils.

Runoff is rapid. Erosion by water causes rills and small gullies, but these generally can be leveled by plowing and tillage. The fertility level of this soil is lower than in uneroded Moody soils. Maintaining good tilth and organic-matter content is a concern of management.

Most of the acreage of this soil is cultivated. Corn, oats, and alfalfa are the principal crops. A few areas have been seeded to tame grass. (Capability unit IIIe-8; Silty range site; Silty to Clayey windbreak suitability group)

Moody and Nora soils, 0 to 5 percent slopes (MrC).—This undifferentiated group of soils is on broad divides between drainageways on the uplands. A thin layer of moderately coarse material is at the surface. Most areas in this mapping unit consist of both Moody and Nora soils, but some consist of only one or the other. These soils are generally so intermingled that it is not practical to separate them on the soil map.

The profile of each soil in this group is similar to the one described as representative of its respective series except that the surface layer is slightly thinner and ranges from silt loam to fine sandy loam. Some areas have silty material over moderately coarse material that is about 30 inches below the surface. Included with these soils in mapping were a few small areas of Ortello and Loretto soils.

Runoff is slow. Moody and Nora soils absorb rainfall readily and are easily worked. Soil blowing is a hazard where the surface layer is not adequately protected.

Most of the acreage of this mapping unit is cultivated. Corn is especially well suited to these soils. Oats, alfalfa, and grain sorghum are the other principal crops. Small acreages are used for range and tame pasture. (Capability unit IIe-3; Silty range site; Sandy windbreak suitability group)

Moody and Nora soils, 5 to 11 percent slopes (MrD).—This undifferentiated group of soils is on divides between drainageways on the uplands. A thin layer of moderately coarse wind-deposited material is at the surface. Most areas in this mapping unit consist of both Moody and Nora soils, but some consist of only one or the other. The soils are generally so intermixed that it is not practical to separate them on the soil map.

The surface layer of the Moody soil in this mapping unit is fine sandy loam, which is 6 to 10 inches thick. The rest of the profile is like the one described as representative of the Moody series. The profile of the Nora soil is similar to the one described as representative of the Nora series except that the surface layer is slightly thinner and consists of silt loam and fine sandy loam. In some areas, tillage has mixed the upper part of the subsoil with the original surface layer.

Included with these soils in mapping were some soils having steeper slopes than those indicated by the name of the mapping unit. Also included were small areas of Ortello and Loretto soils.

Runoff is medium. Moody and Nora soils are easily worked. Soil blowing is a hazard where the surface layer is not adequately protected.

About a half of the acreage of this soil is cultivated. Corn, alfalfa, oats, and grain sorghum are the principal crops. Some areas, mainly those having the steeper slopes, are in tame pasture or native grass. (Capability unit IIIe-3; Silty range site; Sandy windbreak suitability group)

Nora Series

The Nora series consists of deep, well-drained soils that formed in thick deposits of loess on the uplands. Most of these soils are gently sloping to moderately steep and are on convex, narrow ridgetops and on side slopes that border drainageways.

In a representative profile (fig. 6), the surface layer is silty clay loam about 10 inches thick. It is dark grayish brown in the upper part and dark brown in the lower part. The subsoil is brown, friable silty clay loam in the upper 17 inches and pale-brown, friable silt loam in the lower 9 inches. The underlying material is calcareous silt loam that is mixed light yellowish brown and gray.

Nora soils have moderate permeability, high available water capacity, and moderate to moderately low organic-matter content. They release moisture readily to plants. They are low in nitrogen and phosphorus. Soil reaction is neutral in the surface layer and upper part of the subsoil and is moderately alkaline in the lower part of the subsoil and in the underlying material.

Nora soils are suited to cultivated crops. Where they are steepest, they are best suited to tame pasture or hay.

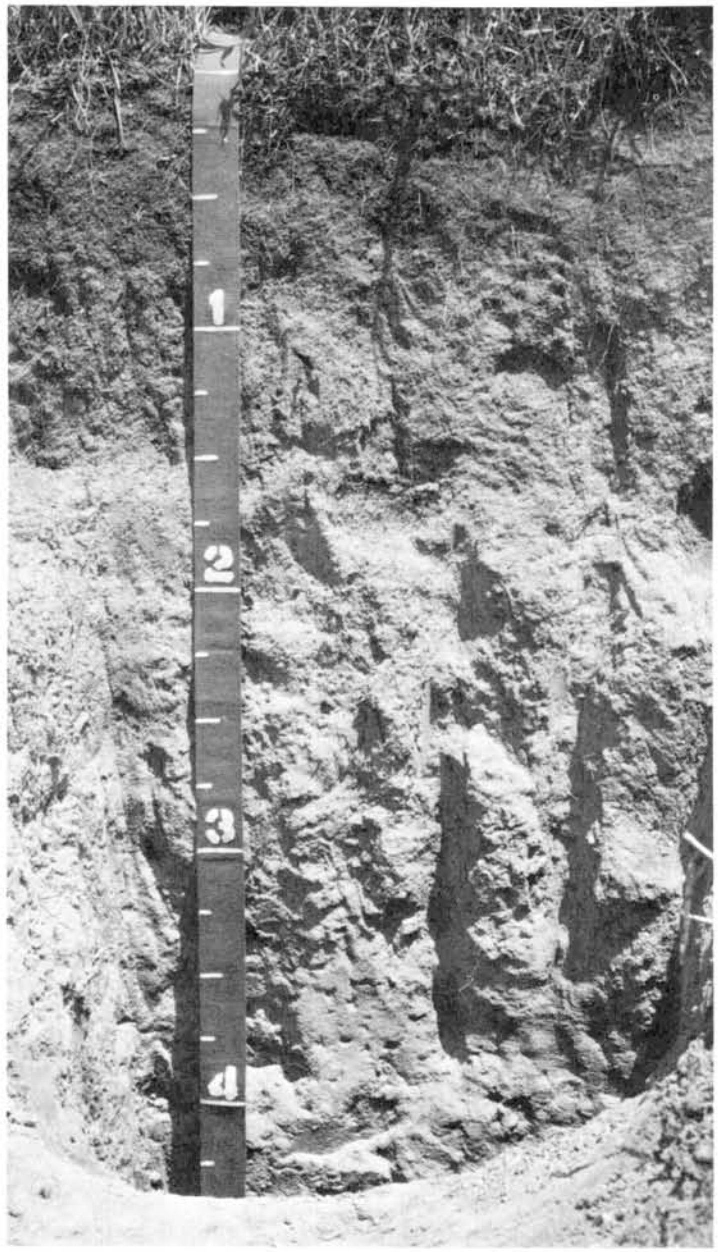

Figure **6.—Profile of a Nora silty clay loam.**

Trees grow well in windbreaks. These soils provide habitat for wildlife and can be used for recreation.

Representative profile of Nora silty clay loam in an area of Nora-Moody silty clay loams, 7 to 11 percent slopes, in a cultivated field, 95 feet north and 800 feet east of the southwest corner of sec. 16, T. 26 N., R. 4 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, subangular blocky structure parting to weak, very fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

A3—6 to 10 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak, very fine, granular structure; hard, friable; neutral; clear, wavy boundary.

B21—10 to 16 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak, fine, subangular

blocky structure; very hard, friable; neutral; clear, wavy boundary.

B22—16 to 27 inches, brown (10YR 5/3) light silty clay loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky structure; very hard, friable; shiny vertical faces on peds; many vesicular pores; violent effervescence; moderately alkaline; many lime concretions; clear, wavy boundary.

B23—27 to 36 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak, coarse, subangular blocky structure; hard, friable; many vesicular pores; violent effervescence; moderately alkaline; common lime concretions; gradual, wavy boundary.

C1—36 to 48 inches, mixed light yellowish-brown (10YR 6/4) and gray (10YR 6/1) silt loam, brown (10YR 5/3) moist; weak, coarse, subangular blocky structure; soft, very friable; many vesicular pores; common, fine, dark reddish-brown segregations; violent effervescence; moderately alkaline; common lime concretions; gradual, wavy boundary.

C2—48 to 60 inches, mixed light yellowish-brown (10YR 6/4) and gray (10YR 6/1) silt loam, yellowish brown (10YR 5/4) moist; common, fine, faint, gray (10YR 5/1) mottles; massive; soft, very friable; many vesicular pores; few, fine, dark reddish-brown segregations; violent effervescence; moderately alkaline; few lime concretions.

The A horizon ranges from 5 to 15 inches in thickness. It is mainly silt loam or silty clay loam but in some places is fine sandy loam. The upper part ranges from dark gray to grayish brown in color. The B horizon is from 17 to 33 inches thick, is silt loam to silty clay loam, and is neutral to moderately alkaline. In uneroded areas, depth to lime ranges from 12 to 24 inches.

Nora soils are associated with Crofton, Moody, and Loretto soils. They have a thicker A horizon than Crofton soils, and the B horizon that is present in Nora soils is lacking in Crofton soils. Nora soils are coarser textured and more weakly developed in the B horizon than Moody soils and have lime nearer the surface. They are finer textured in the upper part of the profile than Loretto soils.

Nora silt loam, 2 to 7 percent slopes, eroded (NoC2).—This soil is on slightly convex ridgetops on the uplands. It generally is in long, narrow areas that range from 5 to 15 acres in size. Its profile is similar to the one described as representative of the Nora series except that the surface layer is slightly lighter colored, is about 6 to 8 inches thick, and is interspersed with lime concretions. In addition, the subsoil is not so well developed and is calcareous.

Included with this soil in mapping were some Nora soils that have steeper slopes. Also included were small areas of Moody soils that are on the wider ridgetops and small areas of Crofton soils that are on the narrower, more convex ridgetops.

Runoff is medium, and erosion by water is the principal hazard. Where erosion is most severe, poor tilth and structure in the surface layer reduce water intake. The organic-matter content, which is moderately low, needs to be increased and then maintained. Nitrogen and phosphorus levels are low.

Most of the acreage of this soil is cultivated. Corn, oats, and alfalfa are the principal crops. Some areas are used for tame pasture or hay. (Capability unit IIIe-8; Limy Upland range site; Silty to Clayey windbreak suitability group)

Nora silt loam, 7 to 11 percent slopes, eroded (NoD2).—This soil is on short side slopes that border drainageways on the uplands. Its profile is similar to the one described as representative of the Nora series except that the surface layer is slightly lighter colored, is thinner, and has lime nearer the surface. Where the soil is most severely eroded, many lime concretions are at and near the surface. Tillage has mixed the surface layer with the upper part of the subsoil. In the southwestern part of the county, the surface layer is loam.

Included with this soil in mapping were Crofton soils that are on the upper parts of the sides of drainageways; these make up about 20 percent of the mapped acreage. Also included were some Moody soils on foot slopes and small areas of Nora silt loam that has slopes of 2 to 7 percent or of 11 to 17 percent.

Runoff is rapid and difficult to control. Erosion by water is the principal hazard. It causes small gullies, but these generally can be leveled by plowing and tilling. The organic-matter content is moderately low and needs to be increased and then maintained. Nitrogen and phosphorus levels are low.

Most of the acreage of this soil is cultivated. Some has been reseeded to tame grass, and some is idle. Corn and alfalfa are the principal crops. This soil is not suited to soybeans. The vegetation provides good habitat for wildlife, especially pheasants. (Capability unit IIIe-8; Limy Upland range site; Silty to Clayey windbreak suitability group)

Nora silt loam, 11 to 17 percent slopes, eroded (NoE2).—This soil is on ridgetops and on mostly west- and south-facing slopes on the uplands. Its profile is similar to the one described as representative of the Nora series except that the surface layer is lighter colored, is about 7 inches thick, is calcareous, and has many lime concretions. Tillage has mixed the upper part of the subsoil with the surface layer. In the southwestern part of the county, the surface layer is loam in some places and is slightly thicker than that described in the profile. Also, in the southwestern part of the county, the subsoil is calcareous silt loam about 20 inches thick.

Included with this soil in mapping were Crofton soils that are in strongly convex areas and that are lighter colored than Nora soils; these make up about 15 percent of the mapped acreage. Also included were small areas of moderately sloping Nora soils and areas of steeper Nora soils.

Runoff is rapid and difficult to control. Where this Nora silt loam is cultivated, erosion by water is a severe hazard. Gullies commonly are present. The organic-matter content is moderately low, and phosphorus and nitrogen levels are low. Maintaining good tilth is a concern of management.

About a half of the acreage of this soil is in pasture, and most of the rest is cultivated. Corn and alfalfa are the principal crops. Some areas have been planted to native grass and are used for range. Severely eroded areas are left idle. The vegetation provides suitable habitat for wildlife. (Capability unit IVe-8; Limy Upland range site; Silty to Clayey windbreak suitability group)

Nora-Moody silty clay loams, 7 to 11 percent slopes (NrD).—The soils in this complex are in irregularly shaped areas that border drainageways on the uplands. About 65 percent of this mapping unit is Nora silty clay loam and 30 percent is Moody silty clay loam. These soils are so closely intermingled that it is not practical to separate them on the soil map. The profile of each soil is similar to the one described as representative of its re-

spective series. Included with these soils in mapping were a few areas of eroded Nora and Moody soils that have a thinner, lighter colored, more calcareous surface layer. Also included were a few areas of Crofton soils on convex slopes and a few areas of Judson silty clay loam near drainageways; these soils constitute about 5 percent of the mapped areas of this complex.

Runoff is medium, and erosion by water is a severe hazard. Plowing and tilling can level small gullies that have been formed by erosion.

Most of the acreage of this complex is cultivated. Corn, soybeans, oats, and alfalfa are the principal crops. Smaller acreages have been planted to grass. The vegetation provides food and nesting for wildlife, especially pheasants. (Capability unit IIIe-1; Silty range site; Silty to Clayey windbreak suitability group)

Nora-Moody silty clay loams, 11 to 17 percent slopes (NrE).—The soils in this complex border drainageways on the uplands and mostly have north- and east-facing slopes. About 75 percent of the mapping unit is Nora silty clay loam and 25 percent is Moody silty clay loam. These soils are so closely intermingled that it is not practical to separate them on the soil map. The profile of each soil is similar to the one described as representative of its respective series except that the surface layer is slightly thicker.

Included with this complex in mapping were small areas of the more gently sloping Nora soils. Also included were a few areas of the eroded Nora silt loam, 11 to 17 percent slopes, and small areas of Crofton soils on narrow ridgetops.

Runoff is rapid, and erosion by water is a severe hazard. Gullies are common and generally are too deeply entrenched to be leveled by plowing and tilling.

About half of the acreage of this complex is in pasture, and most of the remainder is cultivated. Corn, soybeans, oats, and alfalfa are the principal crops. The vegetation provides habitat for wildlife. (Capability unit IVe-1; Silty range site; Silty to Clayey windbreak suitability group)

Ortello Series

The Ortello series consists of deep, well-drained soils that formed in wind-deposited material on uplands. These very gently sloping to moderately sloping soils are mostly on broad divides, but some border upland drainageways.

In representative profile, the surface layer is fine sandy loam about 13 inches thick. It is dark gray in the upper 8 inches and dark grayish brown in the lower part. The subsoil is brown, friable sandy loam about 12 inches thick. The upper 9 inches of the underlying material is light yellowish-brown loamy fine sand. Beneath this layer is pale-brown fine sand to a depth of 60 inches.

Ortello soils have moderately rapid permeability, moderate available water capacity, and moderate organic-matter content. They release moisture readily to plants. Soil reaction is slightly acid in the upper 8 inches of the surface layer and is neutral throughout the rest of the profile.

Ortello soils are suited to cultivated crops, grass, and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Ortello fine sandy loam, 1 to 5 percent slopes, in a cultivated field, 1,840 feet east and 83 feet north of the southwest corner of sec. 16, T. 25 N., R. 1 E.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak, very fine, crumb structure; soft, very friable; slightly acid; abrupt, smooth boundary.

A12—8 to 13 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak and moderate, coarse, subangular blocky structure; soft, friable; neutral; clear, wavy boundary.

B—13 to 25 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; soft, friable; neutral; gradual, wavy boundary.

C1—25 to 34 inches, light yellowish-brown (10YR 6/4) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; neutral; gradual, wavy boundary.

C2—34 to 60 inches, pale-brown (10YR 6/3) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; neutral.

The A horizon is fine sandy loam or loamy fine sand and is 7 to 20 inches thick. The upper part ranges from dark gray to dark grayish brown, and the lower part, from dark grayish brown to grayish brown. The B horizon ranges from 10 to 24 inches in thickness. The C horizon is light yellowish brown to brown in color.

Ortello soils are associated with Blendon and Thurman soils. They have a thinner A horizon than Blendon soils and are less coarse textured than Thurman soils.

Ortello fine sandy loam, 1 to 5 percent slopes (OrC).—This soil is on broad uplands that are mantled by moderately coarse to coarse eolian soil material. Its profile is the one described as representative of the Ortello series.

Included with this soil in mapping were a few soils along drainageways; some of these have a thicker surface layer than that described in the profile, some have a few inches of loamy fine sand in the upper part of the surface layer, and some are silty below a depth of 25 inches.

Runoff is slow. Loss of moisture by deep percolation through the profile is a serious concern. During extended drought, crops are damaged. Soil blowing is a hazard.

Most of the acreage of this soil is cultivated. About 20 percent is in pasture or hay. Corn, oats, and alfalfa are the principal crops. Grain sorghum also is grown. Small areas are in native grass, but most of the pasture has been reseeded to tame grasses. (Capability unit IIIe-3; Sandy range site; Sandy windbreak suitability group)

Ortello fine sandy loam, 5 to 11 percent slopes (OrD).—This soil borders upland drainageways. Its profile is similar to the one described as representative of the Ortello series except that the surface layer is thinner. In places, cultivation has mixed some of the subsoil with the surface layer, which is only 7 to 10 inches thick.

Included with this soil in mapping were small areas of steeper soils and some soils that have a silty subsoil. Also included were small areas of Thurman loamy fine sand.

Runoff is medium. Where the surface layer is not adequately protected, erosion by water is a hazard. This Ortello soil is droughty, and loss of moisture by deep percolation through the profile is a major concern. Soil blowing is a moderate hazard.

Most of the acreage of this soil is in range or tame pasture. About 20 percent is cultivated. Corn, alfalfa, and grain sorghum are the principal crops. (Capability

unit IVe-3; Sandy range site; Sandy windbreak suitability group)

Thurman Series

The Thurman series consists of deep, somewhat excessively drained soils that formed in wind-deposited material. These gently sloping to moderately steep soils are mostly on broad upland plains.

In a representative profile, the surface layer is loamy fine sand about 16 inches thick. It is dark gray in the upper part and gray in the lower part. The transition layer beneath this is grayish-brown loamy fine sand about 4 inches thick. The underlying material is brown loamy fine sand to a depth of 25 inches and brown fine sand below that depth.

Thurman soils have rapid permeability, low available water capacity, and moderately low organic-matter content. They release moisture readily to plants. Soil reaction is slightly acid in the surface layer and neutral in the transition layer and underlying material.

Thurman soils are well suited to use as native range and also are suited to cultivated crops and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Thurman loamy fine sand, 2 to 7 percent slopes, in native hayland, 500 feet north and 100 feet west of the southeast corner of sec. 31, T. 25 N., R. 1 E.:

A11—0 to 10 inches, dark-gray (10YR 4/1) loamy fine sand, very dark brown (10YR 2/2) moist; weak, coarse, subangular blocky structure parting to single grained; loose; slightly acid; clear, smooth boundary.

A12—10 to 16 inches, gray (10YR 5/1) loamy fine sand, very dark grayish brown (10YR 3/2) moist, some mixing of lighter colored sand; single grained; loose; slightly acid; gradual, wavy boundary.

AC—16 to 20 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; neutral; gradual, wavy boundary.

C1—20 to 25 inches, brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; single grained; loose, neutral; gradual, smooth boundary.

C2—25 to 60 inches, brown (10YR 5/3) fine sand, brown (10YR 4/3) moist; single grained; loose; neutral.

The A horizon is dark gray in areas of native grass and gray in cultivated areas. It ranges from 8 to 20 inches in thickness. The AC horizon is 4 to 14 inches thick, is neutral to slightly acid, and is brown to dark gray. The C horizon ranges from sand to loamy fine sand. Some areas have loamy material below a depth of 40 inches.

Thurman soils are associated with Blendon, Ortello, and Valentine soils. They are coarser textured than Blendon soils and have a thinner A horizon. They are coarser textured than Ortello soils and have a thicker A horizon than Valentine soils.

Thurman loamy fine sand, 2 to 7 percent slopes (ThC).—This soil is on broad, undulating plains in areas that range from 30 to 60 acres in size. Its profile is the one described as representative of the Thurman series.

Included with this soil in mapping were a few nearly level soils that have a slightly thicker surface layer and a few small depressions, which are indicated on the detailed soil map by a spot symbol. Also included were a few small areas of Valentine and Ortello soils.

Runoff is slow. This Thurman soil is droughty, and soil blowing is a severe hazard where the surface is not protected or where the grass is overgrazed. Controlling loss of soil moisture and maintaining organic-matter content and fertility are important concerns.

Under good management, this soil provides excellent native range. Most of the acreage is in native grass or hay. Small areas are cultivated. Corn and grain sorghum are the principal crops. Small areas of native trees are common, and trees grow well in windbreaks. The vegetation provides habitat for wildlife. (Capability unit IVe-5; Sandy range site; Sandy windbreak suitability group)

Thurman loamy fine sand, 7 to 15 percent slopes (ThE).—This soil is in long, narrow areas that border well-defined drainageways on sandy uplands. Its profile is similar to the one described as representative of the Thurman series.

Included with this soil in mapping were a few soils that have a slightly thinner surface layer. Also included were small areas of Ortello fine sandy loam, 5 to 11 percent slopes.

This Thurman soil is droughty, and loss of soil moisture by deep percolation through the profile is a primary concern of management. In most places this soil is too sandy and too steep for successful cultivation. Organic-matter content and fertility need to be improved. Erosion by water is a hazard on the steeper slopes, and soil blowing is a severe hazard where the soil is cultivated. Runoff is slow.

Nearly all of the acreage of this soil is in native range. Most areas that once were cultivated have been reseeded to grass. The vegetation, particularly that in small gullies and waste areas, provides habitat for wildlife. (Capability unit VIe-5; Sands range site; Very Sandy windbreak suitability group)

Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes (TsC).—This soil is on sandy uplands in areas that range from 20 to 40 acres in size and that are slightly lower in elevation than surrounding soils. Its profile is similar to the one described as representative of the Thurman series except that the underlying material is silt loam and is at a depth of 30 to 42 inches. Buried former surface layers occur in the underlying material in some places.

Included with this soil in mapping were similar soils that have a thicker and darker surface layer than that described in the profile. Also included were small areas of Thurman loamy fine sand, 2 to 7 percent slopes.

This Thurman loamy fine sand has rapid permeability to a depth of about 36 inches and moderate permeability below that depth. The sandy upper layer allows good root growth early in the growing season, and the higher available water capacity of the silty layer provides moisture needed later in the growing season. Soil blowing is a severe hazard where the surface is left unprotected or where the grass is overgrazed. Runoff is slow.

About a half of the acreage of this soil is cultivated, and the other half is in native range. Corn is well suited to this soil. Alfalfa is grown on a small acreage. (Capability unit IIIe-5; Sandy range site; Sandy windbreak suitability group)

Valentine Series

The Valentine series consists of deep, excessively drained soils on uplands that are mantled by a deposit of coarse soil material. The landscape is rolling.

In a representative profile, the surface layer is very dark grayish brown loamy fine sand about 7 inches thick.

The underlying material to a depth of 60 inches is loose fine sand that is brown in the upper 9 inches and pale brown below.

Valentine soils have rapid permeability, low available water capacity, and low organic-matter content. They release moisture readily to plants. Soil reaction is slightly acid in the surface layer and upper part of the underlying material and is neutral in the lower part of the underlying material.

These soils are suited to native range and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Valentine loamy fine sand, rolling, in native range, 2,000 feet west and 95 feet north of the southeast corner of sec. 31, T. 25 N., R. 1 E.:

A—0 to 7 inches, very dark grayish brown (10YR 3/2) loamy fine sand, very dark brown (10YR 2/2) moist; single grained; loose; slightly acid; clear, wavy boundary.

C1—7 to 16 inches, brown (10YR 5/3) fine sand, brown (10YR 4/3) moist; single grained; loose; slightly acid; clear, wavy boundary.

C2—16 to 60 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grained; loose, neutral.

The A horizon ranges from 5 to 10 inches in thickness and from very dark grayish brown to grayish brown in color. An AC horizon is present in some places. The C1 horizon is brown to pale brown. The C2 horizon ranges from pale brown to very pale brown in color and from neutral to slightly acid in soil reaction.

Valentine soils are associated with Thurman soils, which are finer textured and have a thicker A horizon than Valentine soils.

Valentine loamy fine sand, rolling (3 to 15 percent slopes) (VbE).—This soil is on rolling hills of the uplands in irregularly shaped areas that range from 5 to 20 acres in size. Included with this soil in mapping were some small blowouts.

Runoff is slow. This soil has rapid permeability, and most of the rainfall is absorbed about as rapidly as it falls. It is droughty and is too sandy for successful cultivation. Soil blowing is a severe hazard.

Almost all of the acreage of this soil is in native grass that is used for range or hay. Some areas have a few native trees. This soil provides good habitat for upland wildlife. (Capability unit VIe-5; Sands range site; Very Sandy windbreak suitability group)

Wet Alluvial Land

Wet alluvial land (Wx) consists of very poorly drained, nearly level, deep, loamy soil material on bottom land. The water table is at a depth of 0 to 3 feet during most of the growing season, and ponding occurs during part of most years. In most places, this soil material is calcareous at the surface.

This land type has a water table nearer the surface but otherwise is similar to Lamo soils. In some places, a thin layer of organic matter has formed at the surface. Thin sandy layers are present below a depth of 6 inches in a few areas in the southwestern part of the county.

Wet alluvial land has a high available water capacity, moderately slow permeability, and high organic-matter content. It is too wet to cultivate and is used mainly for pasture. The vegetation consists mostly of coarse grasses but also includes plants suitable for grazing. Many areas provide habitat for wetland wildlife and are used for hunting and other recreation. (Capability unit Vw-7; Wet Land range site; Undesirable windbreak suitability group)

Zook Series

The Zook series consists of deep, somewhat poorly drained, nearly level soils in Logan Creek Valley. These soils formed in silty and clayey alluvium on bottom lands. The water table is at a depth of 3 to 8 feet.

In a representative profile, the surface layer is dark-gray silty clay loam to a depth of 22 inches and dark-gray silty clay between depths of 22 and 30 inches. The subsoil is gray, friable silty clay loam, is about 13 inches thick, and has reddish-brown mottles. The underlying material, below a depth of 43 inches, is firm, dark-gray silty clay.

Zook soils have slow permeability, high available water capacity, and high organic-matter content. They release moisture slowly to plants. Soil reaction is slightly acid in the surface layer and neutral in the subsoil and underlying material.

These soils are suited to cultivated crops, grass, and trees. They provide habitat for wildlife and can be used for recreation.

Representative profile of Zook silty clay loam, 1,150 feet west and 120 feet south of the northeast corner of sec. 15, T. 26 N., R. 5 E.:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, very fine, granular structure; hard, friable; slightly acid; abrupt, smooth boundary.

A12—8 to 22 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate, medium, granular structure; hard, friable; slightly acid; clear, smooth boundary.

A13—22 to 30 inches, dark-gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong, fine, granular structure; very hard, firm; slightly acid; abrupt, smooth boundary.

Bg—30 to 43 inches, gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; common, fine, prominent, reddish-brown (5YR 5/4) mottles; moderate, fine, subangular blocky structure; hard, friable; organic stains on faces of peds and in root channels; neutral; gradual, wavy boundary.

Cg—43 to 60 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) moist; moderate, fine, angular blocky structure parting to massive; very hard, firm; few slickensides; neutral.

The A horizon ranges from silty clay loam to silty clay in texture, from 24 to 34 inches in thickness, and from dark gray to very dark gray in color. The Cg horizon is silty clay or silty clay loam, is grayish brown to dark gray, and has reddish-brown to yellowish-red mottles.

Zook soils are associated with Colo and Lamo soils, both of which are coarser textured than the Zook soils.

Zook silty clay loam (0 to 1 percent slopes) (Zo).—This soil is on bottom land in areas that range from 60 to 100 acres in size. Included with this soil in mapping were a few soils having thin layers that are finer or coarser textured than the soil material in the representative profile.

Runoff is slow or very slow. Flooding is an occasional hazard. Wetness in spring makes this Zook soil slow to warm up and can delay seeding and cultivation. It also increases weed competition. This soil has good workability through only a narrow range of moisture content. The surface layer is slightly deficient in lime.

Nearly all of the acreage of this soil is cultivated. Corn and soybeans are the principal crops. (Capability unit IIw-4; Clayey Overflow range site; Moderately Wet windbreak suitability group)

Use and Management of the Soils

This section explains how the soils in Wayne County can be used. A general discussion of management practices is followed by an explanation of the capability classification used by the Soil Conservation Service and a grouping of the soils into units according to that classification. Information on the yields of the principal crops under prevailing conditions and under improved management is given for each arable soil. Next, management of rangeland is discussed, and soils are grouped into range sites, each of which is a distinctive type of rangeland. There follows a discussion of the suitability of soils for growing trees, particularly in windbreaks. Information also is presented on the capacity of the soil associations to produce food and cover for wildlife. The section concludes with a discussion of the engineering properties of the soils, a description of the systems used in classifying soils for engineering purposes, and interpretations of engineering test data for each of the soil series.

Management of the Soils for Crops [2]

Most of the soils in Wayne County are fertile, and, under good management, they are well suited to crops. The principal concerns of management are soil blowing and water erosion on the uplands, flooding on the bottom lands, and the loss of fertility by erosion. About 7 percent of the soils in the county have slopes of 11 percent or more. Some areas of strongly sloping Crofton, Moody, and Nora soils formerly were cultivated but are now in grass and are used for pasture or hay production. Because of excessive runoff, water erosion on these upland soils is a serious hazard and, in many areas, both sheet and gully erosion are evident. Much of the original surface layer of the soils has been washed away and the soil material has been deposited in the valleys. Runoff from heavy rains on the steeper slopes sometimes causes floods on the bottom lands. Thus, fertility of the soils has been reduced on both the uplands and the bottom lands.

Corn is the major crop in Wayne County, although soybeans, oats, and alfalfa for use as hay are also important. Wheat, barley, and rye are grown in small amounts. Sizable acreages of row crops are grown on Moody, Nora, and Crofton soils on the uplands and on Colo, Lamo, McPaul, Judson, and Kennebec soils on the bottom lands. Some areas formerly used for cropland are now idle. These are commonly part of the diverted acreage in the government crop-control programs.

Pastures in the county consist mainly of bromegrass or, in some places, of a mixture of bromegrass, alfalfa, and other cool-season grasses. Most pastureland is part of a long-time cropping system. Such use is particularly well suited to soils that are severely eroded or that are frequently or occasionally flooded. There is a potential for increasing the acreage of pasture and range and for further improvement of management practices, particularly on gently sloping soils.

According to the 1971 Nebraska Agricultural Statistics Report, only 2,000 acres of cropland in Wayne County is irrigated. Where suitable quantities of ground water are available, the amount of irrigated land can be increased. Irrigation water is used to supplement natural rainfall during dry years. No irrigation is needed during normal years. Soils that are level to very gently sloping are best suited to irrigation. On slopes of more than 9 percent, irrigation causes water erosion and loss of irrigation water through excessive runoff.

Erosion can be controlled by such conservation practices as terracing, contour farming, and establishing grassed waterways. Soil losses from soil blowing and water erosion can be reduced by leaving crop residue on the surface of the soil during tillage operations. Stubble mulching and tillage planting methods of seedbed preparation reduce runoff and sediment losses. On the gently sloping and moderately sloping Moody and Nora soils, erosion can be controlled by the use of cropping systems that include mulch tillage and the limited use of row crops. On the steeper Crofton, Moody, and Nora soils, producing sufficient crop residue to maintain erosion control is not always possible. These soils need a grass cover that provides protection against water erosion, and they can be used for pasture or for hay crops. Flooding can be controlled by the use of diversion terraces on uplands above areas subject to flooding and by the use of other practices that help conserve soil and water. The Kennebec, Colo, Lamo, McPaul, and Zook soils on bottom lands need protection from flooding.

Soils that are to be cultivated should be tested to determine the type of commercial fertilizer that is needed. The amount of fertilizer to be applied depends on the amount of moisture in the soil. For example, less fertilizer is needed on soils that have a dry subsoil during periods of low rainfall than on the same soils when the moisture supply is adequate. Crops on nearly all soils in the county respond well to nitrogen fertilizer. Phosphorus and zinc generally are needed on the eroded Moody, Nora, and Crofton soils.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or to other crops requiring special management. For a complete explanation of the capability classification see U.S.D.A. Handbook No. 210, "Land Capability Classification" (*6*).

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels; the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals

[2] By ERVIN O. PETERSON, conservation agronomist, Soil Conservation Service.

indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife. There are no Class VII soils in Wayne County.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. There are no Class VIII soils in Wayne County.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry. There are no soils in the *c* subclass in Wayne County.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw-3 or IIIe-9. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

Each of the capability units in Wayne County is discussed on the following pages. Soils in each unit and their common features are given first, and then management practices are described. Because the irrigated acreage is so small, only the management of dry-farmed soils is discussed. Crops suited to this kind of management are given, and hazards and limitations are described, together with practices that help overcome them.

CAPABILITY UNIT I-1

This unit consists of the deep, nearly level soils of the Belfore and Kennebec series and of the drained phase of the Colo series. Belfore soils are on tablelands in the upland parts of the county, and Kennebec and Colo soils are on bottom lands. The surface layer of Belfore soils is silty clay loam, and the subsoil is silty clay and silty clay loam. Throughout their profiles, Colo soils are silty clay loam and the Kennebec soil is silt loam.

Soils in this unit are moderately well drained and have moderate to moderately slow permeability. Available water capacity and organic-matter content are high. These soils are easily penetrated by roots, air, and water. They are easy to till and are suitable for intensive farming. The Colo and Kennebec soils are subject to minor, infrequent flooding.

These soils are suited to pasture and to all crops commonly grown in the county. They are especially suited to such row crops as corn, soybeans, and grain sorghum. Row crops can be grown year after year if enough fertilizer is added and weeds and insects are controlled. Crops on these soils respond well to nitrogen fertilizer. Lime is needed in some areas of the Belfore soils. Planting grass in the turn rows and field roads helps to control weeds. Grassed waterways are useful for conducting runoff across the soils in this unit. In places, diversion ditches help to prevent damage by runoff from soils at higher elevation.

CAPABILITY UNIT IIe-1

This unit consists of deep, very gently sloping and gently sloping soils of the Belfore, Judson, and Moody series. These soils are on tablelands, broad ridgetops, and colluvial foot slopes in the uplands. The surface layer, subsoil, and underlying material are silty clay loam and silt loam.

Soils in this unit are moderately well drained to well drained and have moderate to moderately slow permeability. Available water capacity is high, and organic-matter content ranges from moderate to high. Fertility is high, and the soils are easily and deeply penetrated by roots. In cultivated areas, erosion by water is the chief hazard, and maintaining fertility is a concern.

These soils are suited to all crops commonly grown in the county. They are also suited to pasture, windbreaks, and garden crops. A cropping system that includes grasses and legumes improves the organic-matter content, fertility, and tilth of the soils and helps control erosion. Maintaining crop residue on the surface of the soil and using commercial fertilizer also improve fertility. Lime is needed on soils of some upland areas. Terracing, contour farming, and planting grass in waterways are practices that help prevent erosion on long slopes (fig. 7).

Figure 7.—**Grassed waterways and contour farming on a field of Judson and Moody soils.**

CAPABILITY UNIT IIe-3

This unit consists of deep, nearly level to gently sloping soils of the Loretto, Moody, and Nora series. These soils are on uplands. The surface layer ranges from fine sandy loam to silt loam. The subsoil ranges from fine sandy loam to silty clay loam, and the underlying material is silt loam and silty clay loam.

Soils in this unit are well drained and have moderate or moderately slow permeability. Available water capacity is high, and organic-matter content is moderate. These soils absorb water easily and release it readily to plants. They are easily cultivated. Soil blowing is a concern wherever the crop residue is removed and the soils are left bare.

These soils are suited to all crops commonly grown in the county. A cropping system that includes grasses and legumes improves the organic-matter content and fertility and reduces erosion. Maintaining crop residue on the surface of the soil also improves fertility and helps control erosion. Terracing, contour farming, and planting grass in waterways are other erosion-control practices.

CAPABILITY UNIT IIw-3

McPaul silt loam is the only soil in this capability unit. This soil is on bottom lands that are occasionally flooded (fig. 8). The surface layer and underlying material are silt loam.

This soil is moderately well drained and has moderate permeability. Available water capacity and organic-matter content are high. Wetness from flooding sometimes delays planting of crops, and silty deposits left by floodwaters sometimes damage plants. Damage to crops is seldom severe, but the silt damages fences and eventually can fill drainageways and roadside ditches. If the flooding is not too severe, it can benefit crops in years of below-normal rainfall.

Most crops commonly grown in the county are suited to McPaul silt loam. Row crops can be grown year after year if this soil is properly managed. Productivity can be maintained by the use of fertilizers and by returning crop residue to the soil. Alfalfa is damaged by silt unless the adjacent uplands are protected from erosion. Flooding can be controlled by terracing the adjacent uplands and by using diversions.

CAPABILITY UNIT IIw-4

This unit consists of deep, nearly level soils of the Colo, Lamo, and Zook series and the wet phase of McPaul silt loam. These soils are on bottom lands that are wet part of the year. The surface layer, subsoil, and underlying material range from silt loam to silty clay.

Soils in this unit are somewhat poorly drained and have moderate to moderately slow permeability. Available water capacity and organic-matter content are high.

Figure 8.—**Flooding after heavy spring rains is a hazard on this field of McPaul silt loam.**

Depth to water ranges from 2 to 12 feet. Flooding from drainage areas on the upland occurs during periods of heavy summer rains.

Corn and soybeans are the principal crops. Soils in this unit also are suited to pasture (fig. 9). Alfalfa is grown, but yields vary because the root zone is restricted by the moderately high water table in some years. Small grains generally are not grown because the soils generally are subject to excessive wetness during the planting season early in spring. Tile drains can help control wetness where suitable outlets are available, and shallow drains can be used to remove impounded surface water. The flood hazard can be reduced by terracing and other land treatment in areas at higher elevation than these soils.

CAPABILITY UNIT IIIe-1

This unit consists of deep, moderately sloping soils of the Moody and Nora series. These soils formed in loess on the uplands. They are moderately eroded. The surface layer is silty clay loam. The subsoil is silty clay loam or silt loam, and the underlying material is silt loam.

Soils in this unit are well drained and have moderate or moderately slow permeability. Available water capacity is high and organic-matter content is moderate. These soils are easily penetrated by roots and are easy to work. Where these soils are cultivated, the chief concerns of management are maintaining soil structure and high fertility, controlling runoff, and conserving moisture.

Most crops commonly grown in the county are suited to these soils. Erosion is more severe in areas planted to soybeans than in areas used for other cultivated crops. A cropping system that includes grasses and legumes improves the organic-matter content, fertility, and tilth, and helps control erosion. Maintaining crop residue on the surface of the soil and using commercial fertilizer also improve fertility. Terracing, contour farming, and planting grass in waterways are other practices that reduce erosion (fig. 10).

CAPABILITY UNIT IIIe-3

This unit consists of deep, very gently sloping to gently sloping soils of the Blendon and Ortello series and the moderately sloping Moody and Nora soils. These soils are on foot slopes, stream terraces, and broad uplands. The surface layer is fine sandy loam or silt loam. The subsoil ranges from fine sandy loam to silty clay loam, and the underlying material ranges from silty clay to fine sand.

Soils in this unit are well drained and have moderately slow to moderately rapid permeability. Available water capacity is high to moderate, and organic-matter content is moderate. These soils are easy to cultivate. Where they are cultivated, soil blowing and erosion by water are hazards.

Most crops commonly grown in the county are suited to these soils. If soybeans are planted, the soils become highly erodible. Tillage needs to be kept to a minimum. A cropping system that alternates close-growing crops with row crops and which includes grasses and legumes helps control soil blowing and improves the organic-matter content and fertility. Maintaining crop residue on the surface also improves the soil and helps control erosion. Soil blowing is reduced by planting shelterbelts along

Figure 9.—**Good pasture on somewhat poorly drained Lamo silty clay loam.**

field boundaries. Terracing, contour farming, and planting grass in waterways help control erosion by water.

CAPABILITY UNIT IIIe-5

Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes, is the only soil in this unit. This soil is on upland plains. The surface layer is loamy fine sand, and the underlying material is loamy fine sand to a depth of 36 to 42 inches. It is silt loam below that depth.

The soil in this unit is somewhat excessively drained and has rapid permeability to a depth of about 36 inches and moderate permeability below that depth. Available water capacity is moderate, organic-matter content is moderately low, and runoff is slow. This soil is subject to soil blowing. Conserving moisture and maintaining fertility are concerns.

All crops commonly grown in the county are suited to this soil. Crops respond well if enough fertilizer is applied and if adequate moisture is available. Rye and vetch can be used as cover crops or as green manure to help control soil blowing, to conserve moisture, and to improve fertility. Stripcropping, mulch tillage, and planting windbreaks along borders of fields are other practices that help control soil blowing and conserve soil moisture. This soil is slightly acid in the surface layer and needs lime in places to help start legume crops.

CAPABILITY UNIT IIIe-8

This unit consists of eroded, gently sloping soils of the Nora series and eroded, moderately sloping Moody and Nora soils. These soils are on convex ridgetops and on side slopes of upland drainageways. The surface layer is silty clay loam. The subsoil is silty clay loam and silt loam, and the underlying material is silt loam.

Soils in this unit are well drained and have moderate or moderately slow permeability. Available water capacity is high, organic-matter content is moderate, and runoff is medium. Loss of fertility as a result of erosion is a serious concern.

Most crops grown in the county are suited to these soils. If soybeans are planted, the soil becomes highly erodible. Additions of fertilizer are needed for good crop growth. Growing grasses and legumes and returning crop residue to the soil improve the structure and organic-matter content of the soil. Contour farming, mulch planting, and use of terraces, grassed waterways, and grassed field borders help control erosion, conserve moisture, restore fertility, and control runoff (fig. 11).

CAPABILITY UNIT IIIe-9

Crofton silt loam, 2 to 7 percent slopes, eroded, is the only soil in this capability unit. It is on convex ridgetops

Figure 10.—**Contour farming on Moody silty clay loam, 7 to 11 percent slopes.**

on uplands. The soil is silt loam throughout its profile. The surface layer is light colored.

This soil is well drained and has moderate permeability. Available water capacity is high, organic-matter content is moderately low, fertility level is low, and runoff is medium. Loss of fertility as a result of erosion is a serious concern.

Close-growing crops are best suited to this soil. If row crops, particularly soybeans, are planted, the soil becomes highly erodible. Growing grasses and legumes and returning crop residue to the soil help control erosion and improve the structure and organic-matter content of the soil. Additions of fertilizer, particularly phosphorus, are needed for good crop growth. Contour farming, terracing, and planting grass in waterways and field borders are practices that conserve moisture, improve fertility, and help control erosion.

CAPABILITY UNIT IIIw-2

The only soils in this unit are those in the Fillmore complex. These nearly level soils are in upland depressions. The surface layer is silt loam and silty clay loam, and the subsoil is firm silty clay. Water is ponded on some of the lower areas during most of the year.

Soils in this unit are poorly drained and have very slow permeability. Available water capacity and organic-matter content are high. Surface drainage is a concern where the depressions lack drainage outlets. Excess water is a hazard to cultivation and weed control.

When not inundated by runoff from adjacent soils, the soils in this unit are fairly well suited to most crops commonly grown in the county. Usually they are too wet for growing alfalfa. Some method of removing excess water is needed for consistent crop production. Terraces, grassed waterways, and grassed diversions on adjacent higher soils can help prevent runoff from those soils onto soils in this unit. Lime commonly is needed.

CAPABILITY UNIT IVe-1

Nora-Moody silty clay loams, 11 to 17 percent slopes, are the only soils in this capability unit. These moderately steep soils border upland drainageways. They have mostly north- and east-facing concave slopes and are moderately eroded. The surface layer is silty clay loam. The subsoil is silty clay loam and silt loam, and the underlying material is silt loam.

Soils in this unit are well drained and have moderate or moderately slow permeability. Available water capacity

Figure 11.—**Field of Nora silt loam, 7 to 11 percent slopes, eroded, protected by terraces, contour farming, and mulch planting.**

is high, organic-matter content is moderate, and runoff is rapid. Sheet and gully erosion are serious hazards.

These soils are best suited to permanent grass or hay. Most crops commonly raised in the county can be grown, but soybeans are poorly suited. Because of the erosion hazard, row crops should be grown only 1 year in 5. Growing grasses or legumes and adding barnyard manure to the soils help control erosion and improve fertility and tilth. Mulch tillage reduces runoff, increases the rate of water intake, improves fertility and tilth, and helps control erosion. Contour farming, terracing, stripcropping, and planting grass in waterways and turnrows are other practices that help control erosion and runoff.

CAPABILITY UNIT IVe-3

Ortello fine sandy loam, 5 to 11 percent slopes, is the only soil in this capability unit. This deep, moderately sloping soil borders the bottom lands of upland drainageways. The surface layer and subsoil are fine sandy loam, and the underlying material is fine sand and loamy fine sand.

This soil is well drained and has moderately rapid permeability. Available water capacity and organic-matter content are moderate. Soil blowing and water erosion are the major hazards.

Pasture and forage crops are better suited to this soil than are cultivated crops, although most crops commonly grown in the county can be produced. Growing grasses and legumes and returning crop residue to the soil help control erosion and improve fertility and tilth. Terracing and contour farming also can help control erosion. Grassed waterways are difficult to maintain because the soil is moderately coarse to coarse textured. In places, lime is needed to help start legume crops.

CAPABILITY UNIT IVe-5

This unit consists of soils in the Hadar and Thurman series. They range from gently sloping to moderately steep. These deep soils are on uplands. The surface layer is loamy fine sand. The subsoil and underlying material range from clay loam to loamy fine sand.

Soils in this unit are well drained to somewhat excessively drained and have moderately slow to rapid permeability. Available water capacity is low or moderate, organic-matter content is moderately low, and the fertility level is low. Water erosion is a hazard, particularly on the steeper parts of the landscape. Where these soils are cultivated, soil blowing is the main hazard.

These soils are used for cultivated crops and native grass, but areas that have Hadar soils included are marginal for cultivated crops. Close-growing crops, such as alfalfa, grass, and small grain, are better suited than row crops because they afford greater protection against soil blowing. They make their best growth in spring when

rainfall is highest, and they also provide ground cover most of the year. If row crops, such as corn or sorghum, are grown, soil blowing can be reduced by planting narrow strips of the row crops alternately with narrow strips of close-growing crops or by planting a row crop in the spring and then interplanting with rye and hairy vetch in the fall. Trees in windbreaks can help reduce soil blowing.

CAPABILITY UNIT IVe-8

The only soil in this unit is the eroded Nora silt loam, 11 to 17 percent slopes, eroded. This deep, moderately steep soil is on ridgetops and west- and south-facing slopes on uplands. The surface is silty clay loam. The subsoil is silty clay loam and silt loam, and the underlying material is silt loam.

This soil is well drained and has moderate permeability. Available water capacity is high, organic-matter content is moderately low, and runoff is rapid. This soil is subject to sheet, rill, and gully erosion.

Close-growing crops, hay, and pasture are best suited to this soil. Most crops grown in the county can be produced, but row crops should be grown infrequently. The soil is highly erodible if planted to soybeans. Growing grasses and legumes improves the organic-matter content and fertility. Stripcropping helps control erosion (fig. 12). Retaining crop residue on the surface of the soil also helps control erosion and improves the fertility. Contour farming, terracing, planting trees, and planting grass in waterways, turnrows, and field borders are other practices that conserve soil and water and help control erosion and runoff.

CAPABILITY UNIT IVe-9

The only soil in this capability unit is Crofton silt loam, 7 to 11 percent slopes, eroded. This soil is on convex slopes on the upland. It is silt loam throughout its profile. Because of erosion, the surface layer is light colored.

This soil is well drained and has moderate permeability. Available water capacity is high, organic-matter content is moderately low, fertility level is low, and runoff is rapid. These soils are subject to severe sheet, rill, and gully erosion.

Close-growing crops, hay, and pasture are best suited to this soil. Most crops raised in the county can be grown, but row crops should be grown infrequently. The soil is highly erodible if planted to soybeans. Growing grasses and legumes improves the organic-matter content and fertility. Stripcropping helps control erosion. Retaining crop residue on the surface of the soil improves the fertility and also helps control erosion. Contour farming, terracing, planting trees, and planting grass in waterways, turnrows, and field borders are other practices that conserve soil and water and help control erosion and runoff.

CAPABILITY UNIT Vw-7

Wet alluvial land is the only mapping unit in this capability unit. This soil material formed in alluvium on bottom lands and is mainly silty clay loam. The water

Figure 12.—Contour stripcropping used to control erosion on eroded Nora soils.

table is at a depth of 0 to 3 feet during most of the growing season, and ponding occurs during part of most years.

This soil material is very poorly drained and has moderately slow permeability. Available water capacity and organic-matter content are high. Wetness is the principal concern.

Wet alluvial land is used mostly as pasture and as native habitat for wildlife. It is too wet for cultivation. During seasons of heavy rainfall, it is too wet to be used for grazing. The native vegetation consists mostly of willows, cattails, sedges, reeds, and other plants that tolerate a high degree of wetness. V-shaped drains and tile drains can provide drainage and lower the water table so that the more desirable grasses can be established. Where the primary use of this land type is for wildlife, drainage facilities should not be installed.

CAPABILITY UNIT VIe-5

This capability unit consists of deep, gently sloping to moderately steep soils of the Thurman and Valentine series. These soils formed in wind-deposited material on uplands. The surface layer is loamy fine sand, and the underlying material is loamy fine sand or fine sand.

Soils in this unit are somewhat excessively drained to excessively drained and have rapid permeability. Available water capacity is low and organic-matter content is moderately low to low. These soils are sandy and, if cultivated, they are susceptible to severe soil blowing and erosion by water.

Most of these soils are in native grass and are used for range, for raising hay, and as habitat for wildlife. They are not suited to cultivation.

CAPABILITY UNIT VIe-9

The only soil in this capability unit is Crofton silt loam, 11 to 20 percent slopes, eroded. This deep soil is on some of the steepest slopes on the loess uplands. The thin surface layer and underlying material are silt loam.

This soil is well drained and has moderate permeability. Available water capacity is high and organic-matter content is moderately low. Moisture is released readily to plants. Erosion by water is the principal hazard on these moderately steep slopes. Because runoff is rapid, much of the rainfall does not penetrate the soil. Moisture needs to be conserved. Gullies form and can become serious hazards.

The eroded Crofton silt loam is best suited to native grass. Where presently cultivated, this soil needs to be converted to range. Mixtures of adapted native grasses similar to those present under natural climax conditions are best suited. A cover should be maintained on the soil during preparation of the seedbed and during planting time. Grazing needs to be regulated. Not more than one-half of the current year's desirable vegetation can be safely removed. Weeds and other noxious plants can be controlled by mowing or spraying. Small areas of this soil can be planted to trees and shrubs as habitat for wildlife. Some areas adjacent to drainageways are good sites for livestock water supplies or for recreational lakes.

Predicted yields

Yield predictions are an important interpretation that can be made in a soil survey. The predicted average acre yields of the principal crops grown on soils of Wayne County are given in table 2. These predictions are based on average yields during the period 1966–70 and do not represent yields that might be obtained in later years under new technology.

Yields for various crops were determined from yield records and other pertinent information obtained by interviewing farmers, supervisors of Soil and Water Conservation Districts, representatives of the Soil Conservation Service and Agricultural Extension Service, and others familiar with the soils and agriculture in the county. Information from the Agriculture Stabilization and Conservation Service and research data from agricultural experiment stations also were used.

Crop production is influenced by many factors. Soil features such as depth, texture, slope, and drainage strongly affect crop yields; erodibility, available water capacity, permeability, and fertility also are important. Additional factors affecting yields are the cropping pattern, timeliness of operations, plant population, crop variety, and daily, seasonal, and annual fluctuations in the weather.

Two sets of predicted yields are given in table 2 for each of the principal crops. The first, in columns A, consists of those expected under an average level of management and the second, in columns B, consists of those expected under a high level of management. Because little irrigation is practiced in the county, no irrigation yields are given.

Under the average level of management, moderate efforts are made to maintain fertility, but the proper amount of fertilizer or the time of application may not be that indicated by soil tests. Practices to control erosion and to maintain tilth are not used as effectively as possible. Certified seed of improved varieties is not planted consistently, and plant populations are not always properly established. Timeliness of field operations and effective disease, weed, and insect control also may be lacking. Improved management should result in significantly higher yields.

Under the high level of management, fertility is maintained and fertilizer or lime is applied at rates indicated by soil tests and field experiments. Crop residue is returned to the soil to improve tilth and to maintain or increase organic matter. Adapted varieties of seed are used, and plant populations are optimum. Weeds, insects, and diseases are controlled effectively. Water erosion and soil blowing also are controlled, and wet soils are drained. Tillage, seeding, and cultivation practices are performed at the proper time and are adequate. The soil is protected from deterioration and is used in accordance with its capacity.

The results given in table 2 can be best used to compare the productivity of one soil with another. The table gives no recommendations, and the yields given do not apply to specific farms or farmers. Owing to the effect of weather, to sudden infestations of disease or insects, or to other unpredictable hazards, yields in any one year on a particular soil may vary considerably from the figures given. Improved technology in the future may make table 2 obsolete; the yield data should be updated when improved methods significantly increase production.

TABLE 2.—*Predicted average acre yields of principal crops*

[In columns A are yields under ordinary management; in columns B are yields under improved management. Absence of yield indicates the crop is not suited to the soil or that it is grown only in small amounts]

Mapping unit	Corn		Oats		Soybeans		Alfalfa hay		Tame pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit-months*[1]	*Animal-unit-months*[1]
Belfore silty clay loam, 0 to 1 percent slopes	64	77	39	50	17	35	1.5	3.0	2.0	4.8
Belfore-Moody silty clay loams, 1 to 3 percent slopes	68	79	44	55	22	39	3.0	4.0	2.0	4.8
Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes	44	70	27	39	17	22	2.0	3.0	1.8	4.0
Colo silt loam, occasionally flooded	76	87	42	55	16	28	4.0	5.0	3.3	5.0
Colo silty clay loam, drained	82	110	55	77	22	39	3.5	4.0	4.0	5.0
Colo and Lamo silty clay loams	65	100	44	65	17	33	4.0	5.0	4.0	5.0
Crofton silt loam, 2 to 7 percent slopes, eroded	27	50	22	33	11	24	2.0	3.0	.8	1.5
Crofton silt loam, 7 to 11 percent slopes, eroded	22	44	16	28	11	22	2.0	3.0	.7	1.2
Crofton silt loam, 11 to 20 percent slopes, eroded	---	---	---	---	---	---	---	---	---	---
Fillmore complex	22	50	17	44	10	27	1.0	2.0	2.0	4.5
Hadar-Thurman complex, 5 to 15 percent slopes	27	50	17	28	10	22	1.5	2.5	.6	1.0
Judson silt loam, 2 to 7 percent slopes	71	88	44	70	22	33	3.5	4.0	3.0	5.0
Kennebec silt loam	82	121	50	77	22	36	3.5	4.0	4.0	5.0
Lamo silt loam, occasionally flooded	66	84	44	66	17	33	4.0	5.0	3.3	5.0
Lamo silty clay loam	67	99	44	68	18	35	4.0	5.0	3.5	5.0
Loretto fine sandy loam, 0 to 2 percent slopes	44	70	38	65	15	33	3.0	4.0	2.0	4.0
McPaul silt loam	70	86	36	50	17	28	3.0	4.0	3.0	4.2
McPaul silt loam, wet	58	82	35	48	10	25	3.5	4.5	3.3	5.0
Moody silt loam, 2 to 7 percent slopes	66	83	38	66	22	28	2.5	3.5	2.0	4.5
Moody silty clay loam, 2 to 7 percent slopes	70	86	50	77	24	33	3.5	4.0	2.4	4.9
Moody silty clay loam, 7 to 11 percent slopes	60	77	50	77	20	31	2.5	3.0	2.0	4.5
Moody silty clay loam, 7 to 11 percent slopes, eroded	55	72	38	60	17	28	2.5	3.0	2.0	4.5
Moody and Nora soils, 0 to 5 percent slopes	44	64	36	60	14	26	3.0	4.0	1.2	4.0
Moody and Nora soils, 5 to 11 percent slopes	38	55	33	64	11	22	2.5	3.5	1.1	3.5
Nora silt loam, 2 to 7 percent slopes, eroded	44	66	32	62	16	26	3.5	4.0	1.3	4.0
Nora silt loam, 7 to 11 percent slopes, eroded	44	66	32	62	12	24	3.5	4.0	1.3	4.0
Nora silt loam, 11 to 17 percent slopes, eroded	28	52	22	55	6	17	2.0	3.0	1.1	3.0
Nora-Moody silty clay loams, 7 to 11 percent slopes	55	66	44	66	16	25	3.5	4.0	1.3	4.0
Nora-Moody silty clay loams, 11 to 17 percent slopes	30	58	39	60	8	20	2.0	3.0	1.1	3.0
Ortello fine sandy loam, 1 to 5 percent slopes	38	66	22	33	17	20	1.5	2.5	1.5	4.5
Ortello fine sandy loam, 5 to 11 percent slopes	33	55	17	28	11	17	1.5	2.0	1.5	4.0
Thurman loamy fine sand, 2 to 7 percent slopes	33	55	22	33	6	11	1.0	2.0	.6	1.1
Thurman loamy fine sand, 7 to 15 percent slopes	---	---	---	---	---	---	---	---	---	---
Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes	45	73	27	39	11	17	1.5	2.5	1.5	3.0
Valentine loamy fine sand, rolling	---	---	---	---	---	---	---	---	---	---
Wet alluvial land	---	---	---	---	---	---	---	---	---	---
Zook silty clay loam	66	100	28	42	22	30	4.0	5.0	2.6	4.5

[1] Animal-unit-month is a term used to express the carrying capacity of pasture. It is the number of animal units, or 1,000 pounds of live weight, that can be grazed on an acre of pasture for a period of 30 days.

Management of the Soils for Range [3]

The acreage of range (land in native grass) in Wayne County is very small and consists mostly of small tracts in the southwestern part of the county. It generally is not suitable for cultivation. The success of a rangeland program depends upon the way a livestock farmer manages his grass and feed reserves. The livestock farmer who has range should know that different kinds of range produce different kinds and amounts of native grass. To manage his range properly, an operator needs to know which range sites are in his holdings and the plants that can grow in each. Management practices that will favor the growth of the best forage plants on each site then can be used. Reseeding native grasses or introducing improved strains generally can improve range condition, and optimum forage composition can be maintained by proper grazing and deferred grazing practices. Farmers who have soils under cultivation but who desire to reseed them to grass can obtain technical help from the local Soil Conservation Service to determine the best seeding program for the range sites to which those soils are assigned.

Range sites and condition classes

A range site is land that has the potential to produce a distinctive community of native plants. Commonly referred to as climax vegetation, this plant community differs from that of other range sites in kinds or proportion of plants or in total annual yield. Climax vegetation is the combination of plants that originally grew on a given site and is generally the most productive combination of range plants on that site. Different range sites require

[3] By PETER N. JENSEN, range conservationist, Soil Conservation Service.

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different stocking rates and other variations in management.

Range plants differ in their response to grazing. Generally, *decreasers* are the most palatable to livestock and consequently become fewer where subjected to close grazing. *Increasers*, which are less palatable, withstand grazing better and thus tend to replace the decreasers. Other plants that formerly could not compete with the decreasers now can establish themselves in the plant community. Most of these *invaders* are annual weeds that have little value for grazing.

Range condition is the current state of the plant community compared to climax vegetation. The following classification is used in describing the existing plant stand in range sites in relation to the potential plant stand. The condition class is *excellent* if 76 to 100 percent of the plant community consists of species that compose the climax vegetation; *good* if 51 to 75 percent; *fair* if 26 to 50 percent; and *poor* if 0 to 25 percent. Changes in range condition are due mainly to the intensity of grazing and to drought.

Descriptions of range sites

The ten range sites in Wayne County are described in the pages that follow. Each description contains the following information: the soil series and land types present in the site, the common characteristics of the soils, the topography, the plants composing the climax vegetation, the dominant plants when the site is in excellent range condition and when it is in poor range condition, and the annual forage yield when the site is in excellent condition. The reader should not infer that all the soils in the indicated soil series are in the range site. To determine which soils of a given series are present, he should refer to the "Guide to Mapping Units," which indicates the range site(s) for each soil mapping unit.

WET LAND RANGE SITE

Wet alluvial land is the only mapping unit in this site. It consists of very poorly drained, nearly level, deep loamy alluvium on bottom lands. The water table is at a depth of 0 to 3 feet. Permeability is moderately slow.

At least 50 percent of the climax plant cover consists of prairie cordgrass and other decreaser grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are members of the sedge family. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, red clover, redtop, dandelion, sparse amounts of prairie cordgrass, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 6,000 pounds in unfavorable years to 7,000 pounds in favorable years.

SUBIRRIGATED RANGE SITE

This site consists of those Colo, Lamo, and McPaul soils that have the water table within a depth of 2 to 10 feet. These are nearly level, poorly drained to somewhat poorly drained, deep soils on bottom lands. The surface layer and underlying material are silt loam or silty clay loam. Permeability is moderately slow or moderate.

At least 80 percent of the climax plant cover consists of big bluestem, indiangrass, switchgrass, little bluestem, prairie cordgrass, Canada wildrye, and other decreaser grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are Kentucky bluegrass, green muhly, and members of the sedge family. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, redtop, dandelion, western ragweed, foxtail barley, white clover, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 5,000 pounds in unfavorable years to 6,000 pounds in favorable years.

SILTY OVERFLOW RANGE SITE

McPaul silt loam is the only soil in this site. It is a nearly level, moderately well drained, deep soil on narrow bottom lands of upland drainageways and at the edge of wide bottom lands that receive runoff from adjacent soils at higher elevations. It is subject to periodic flooding. The surface layer and underlying material are silt loam. Permeability is moderate.

At least 80 percent of the climax plant cover consists of big bluestem, switchgrass, indiangrass, prairie cordgrass, little bluestem, porcupinegrass, Canada wildrye, and other decreaser grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are Kentucky bluegrass, green muhly, and members of the sedge family. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western ragweed, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 4,000 pounds in unfavorable years to 5,500 pounds in favorable years.

CLAYEY OVERFLOW RANGE SITE

This site consists of Fillmore and Zook soils. These are nearly level, somewhat poorly drained and poorly drained, deep soils on bottom lands and in depressions on the upland. They are subject to occasional flooding. The surface layer is silt loam, silty clay loam, or silty clay. The subsoil is silty clay or silty clay loam, and the underlying material is silty clay. Permeability is slow or very slow.

At least 65 percent of the climax plant cover consists of big bluestem, switchgrass, indiangrass, little bluestem, prairie cordgrass, Canada wildrye, and other decreaser grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are Kentucky bluegrass and members of the sedge family. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western ragweed, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 2,500 pounds in unfavorable years to 4,500 pounds in favorable years.

SILTY LOWLAND RANGE SITE

This site consists of Kennebec soils and the drained Colo silty clay loam. These are nearly level, moderately well drained, deep soils on bottom lands. The water table is at a depth of 8 to 12 feet. The surface layer and underlying material range from silt loam to silty clay loam. Permeability is moderate or moderately slow.

At least 80 percent of the climax plant cover consists of big bluestem, indiangrass, switchgrass, little bluestem, porcupinegrass, Canada wildrye, and other decreaser

grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are Kentucky bluegrass, tall dropseed, green muhly, and members of the sedge family. When the site is in poor range condition, the typical plant community consists of Kentucky bluegrass, western ragweed, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 3,500 pounds in unfavorable years to 5,000 pounds in favorable years.

SANDS RANGE SITE

This site consists of Hadar, Thurman, and Valentine soils. These are gently sloping to moderately steep, deep soils on uplands. They are well drained, somewhat excessively drained, or excessively drained. The surface layer is loamy fine sand. The subsoil and underlying material range from clay loam to fine sand. Permeability is moderately slow to rapid.

At least 70 percent of the climax plant cover consists of sand bluestem, switchgrass, indiangrass, prairie junegrass, porcupinegrass, and other decreaser grasses. The rest is made up of the other perennial grasses and forbs. The principal increasers are little bluestem, prairie sandreed, needleandthread, blue grama, Scribner panicum, and sand dropseed. When the site is in poor range condition, the typical plant community consists of blue grama, sand dropseed, sand paspalum, and western ragweed.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 3,000 pounds in unfavorable years to 4,500 pounds in favorable years.

SANDY RANGE SITE

This site consists of Blendon, Loretto, and Ortello soils, and the gently sloping Thurman loamy fine sand. These are nearly level to moderately sloping, deep soils on foot slopes, stream terraces, and uplands. They are well drained or somewhat excessively drained. The surface layer is fine sandy loam or loamy fine sand. The subsoil ranges from clay loam to fine sandy loam, and the underlying material from clay loam to fine sand. Permeability is moderate to rapid.

At least 55 percent of the climax plant cover consists of sand bluestem, switchgrass, indiangrass, porcupinegrass, and other decreaser grasses. The rest is made up of other perennial grasses and forbs. The principal increasers are little bluestem, needleandthread, prairie sandreed, sand dropseed, and members of the sedge family. When the site is in poor range condition, the typical plant community consists of blue grama, sand dropseed, Scribner panicum, western ragweed, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual yield of air-dry forage ranges from 2,500 pounds in unfavorable years to 4,000 pounds in favorable years

SILTY RANGE SITE

This site consists of Judson and Moody soils and those Nora soils that are not eroded. These are gently sloping to moderately steep, well-drained, deep soils on uplands. The surface layer ranges from fine sandy loam to silty clay loam. The subsoil is silty clay loam or silt loam, and the underlying material is silt loam. Permeability is moderate to moderately slow.

At least 80 percent of the climax plant cover consists of big bluestem, little bluestem, indiangrass, switchgrass, porcupinegrass, and other decreaser grasses. The rest is made up of other perennial grasses, forbs, and shrubs. The principal increasers are side-oats grama, tall dropseed, Scribner panicum, purple lovegrass, and sedges. When the site is in poor range condition, the typical plant community consists of sand dropseed, blue grama, Scribner panicum, and western ragweed.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 3,000 pounds in unfavorable years to 4,500 pounds in favorable years.

CLAYEY RANGE SITE

This site consists only of Belfore soils. These are nearly level to very gently sloping, moderately well drained, deep soils on uplands. The surface layer is silty clay loam. The subsoil is silty clay and silty clay loam, and the underlying material is silt loam. Permeability is moderately slow.

At least 65 percent of the climax plant cover consists of big bluestem, little bluestem, switchgrass, indiangrass, prairie dropseed, and other decreaser grasses. The rest is made up of other perennial grasses, forbs, and shrubs. The principal increasers are side-oats grama, blue grama, tall dropseed, Scribner panicum, and members of the sedge family. When the site is in poor range condition, the typical plant community consists of prairie three-awn, Scribner panicum, blue grama, western ragweed, and rush, bulrush, spike sedge, flat sedge, and other sedges.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 2,000 pounds in unfavorable years to 4,500 pounds in favorable years.

LIMY UPLAND RANGE SITE

This site consists of Crofton soils and the eroded Nora silt loams. These are gently sloping to moderately steep, well-drained, deep, calcareous soils on uplands. The surface layer and subsoil are silt loam and silty clay loam, and the underlying material is silt loam. Permeability is moderate.

At least 75 percent of the climax plant cover consists of little bluestem, big bluestem, switchgrass, indiangrass, prairie dropseed, and other decreaser grasses. The rest is made up of other perennial grasses, forbs, and shrubs. The principal increasers are side-oats grama, blue grama, Scribner panicum, and sedges. When the site is in poor range condition, the typical plant community consists of blue grama, hairy grama, sand dropseed, Scribner panicum, Kentucky bluegrass, and western ragweed.

When the range is in excellent condition, the annual acre yield of air-dry forage ranges from 2,000 pounds in unfavorable years to 3,500 pounds in favorable years.

Management of the Soils for Woodland and Windbreaks [4]

Several kinds of trees and shrubs are native to Wayne County. These grow on bottom land where water is continuously available at shallow depth or in protected places where water tends to collect and persist. Many windbreaks of trees and shrubs have been established

[4] By JAMES W. CARR, JR., forester, Soil Conservation Service.

on the uplands and stream terraces as well as on bottom land.

Native woodland

Most of the native woodland in Wayne County is limited to narrow strips along the larger streams. Extensive stands consisting principally of American elm, boxelder, green ash, hackberry, willows, walnut, cottonwood, and some woody shrubs grow on the bottom lands of Logan Creek and Deer Creek. These grow mainly on the occasionally flooded phases of Colo silt loam and Lamo silt loam.

Much of the woodland is grazed, and in places where it has been overgrazed, less desirable trees and shrubs have become more prevalent. Black walnut, which has a ready market and a high value, is being depleted rapidly. Under proper management, this species could become better established. It not only would be a source of future income but also would be a means of controlling erosion along the streams. Native trees and shrubs add to the natural beauty of the area. They also provide food and cover for wildlife and thereby contribute to the recreational potential of the county.

Windbreaks

Early settlers in Wayne County planted trees for protection from wind, for shade, and to provide a source of fenceposts. Throughout the years, landowners have continued to plant trees in windbreaks to protect their buildings and livestock. At the present time, windbreaks are established mostly to help prevent soil blowing and crop damage due to wind. If suitably located, windbreaks also contribute to human comfort, reduce home heating costs, control snow drifting, provide shelter for livestock, improve conditions for wildlife, and beautify the countryside.

Although trees are not easily established in Wayne County, the observance of basic rules of tree culture can result in a high degree of tree survival. A good windbreak consists of trees and shrubs suited to the soils in which they are to grow. Healthy seedlings of adapted species, properly planted in a well-prepared soil and carefully tended after planting, can survive and grow well. Specific information on the design, establishment, and maintenance of windbreaks is available from the Soil Conservation Service and from local representatives of the Agricultural Extension Service. Following are some general guides for growing of trees in windbreaks.

Growth of trees in windbreaks

The rate of tree growth in a windbreak depends upon the soil and kinds of trees planted. Fertility, available moisture, and direction and steepness of slope are soil properties that affect the growth rate. Spacing and arrangement of species within the windbreak also are important factors. Some kinds of trees, especially cottonwood, grow fast but tend to die young. Siberian elm and Russian-olive also grow rapidly and often are shortlived. Furthermore, they are likely to spread where not wanted.

The trees best suited for windbreaks in Wayne County are eastern redcedar and ponderosa pine (fig. 13), both of which are native to Nebraska. These trees are high in survival and vigor compared to other kinds of trees. Because they hold their needles through the winter, they

Figure 13.—Young farmstead windbreak on Belfore silty clay loam, 0 to 1 percent slopes. Trees have had excellent cultivation and should grow rapidly.

give maximum protection when it is most needed. Eastern redcedar grows about 1 foot per year and can reach a height of 30 to 40 feet. Ponderosa pine grows slightly faster and is somewhat taller at maturity. The broadleaf trees that are well suited for windbreaks in the county are honeylocust, green ash, and hackberry. The following shrubs are also well suited: lilac, honeysuckle, American plum, and chokecherry. Boxelder and mulberry commonly freeze back in severe winters, and green ash is subject to damage by borers.

Table 3 gives the relative vigor and average height at 20 years for several kinds of trees that commonly are planted on soils of the principal windbreak suitability groups. The ratings for vigor are based upon observations of the relative vigor and of the general condition of the trees. A rating of *good* indicates that leaves (or needles) are normal in color and growth, that only small amounts of dead wood occur within the live crowns of the trees, and that damage caused by disease, insects, and climate is small. *Fair* indicates either that leaves (or needles) are somewhat abnormal in color and growth; that substantial amounts of dead wood occur within the live crowns; that damage due to disease, insects, or climate is moderate; or that the current year's growth is obviously less than normal. *Poor* indicates either that leaves (or needles) are very abnormal in color and growth; that very large amounts of dead wood occur within the live crowns; that damage due to disease, insects, or climate is extensive; or that the current year's growth is almost negligible.

Windbreak suitability groups

The soils of Wayne County are grouped according to their suitability for windbreaks. Soils in any one group produce similar growth of similar survival capacity under normal weather conditions and with proper care. The soil series represented in a windbreak suitability group are given in the description of the group, but the reader should not assume that all the soils of the indicated series are necessarily among the soils that make up the group. To find the names of all the soils in any group, reference should be made to the "Guide to Mapping Units" at the back of this survey. Each of the following descriptions of the windbreak suitability groups in Wayne County lists the trees and shrubs that are suited to planting in soils of that group.

SILTY TO CLAYEY WINDBREAK SUITABILITY GROUP

This group consists of Belfore, Crofton, Judson, Kennebec, Moody, and Nora soils, and the drained Colo silty clay loam. These deep, nearly level to moderately steep soils are on uplands, colluvial foot slopes, and bottom lands. The surface layer, subsoil, and underlying material are silt loam or silty clay loam, except where the subsoil of Belfore soils includes some silty clay. Soils in this windbreak suitability group have a high available water capacity.

Adapted kinds of trees have a good chance for survival and growth if not subjected to drought or to excessive competition from weeds and grasses for the available moisture. Water erosion is a hazard where these soils are gently sloping to moderately steep.

Conifers suitable for planting are eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, white pine, Colorado blue spruce, and Norway spruce. Suitable deciduous trees are Russian mulberry, Russian-olive, hackberry, honeylocust, green ash, bur oak, and red oak. Shrubs that grow well are lilac, cotoneaster, honeysuckle, chokeberry, American plum, and autumn-olive.

SANDY WINDBREAK SUITABILITY GROUP

This group consists of Blendon, Hadar, Loretto, Moody, Nora, and Ortello soils, and the gently sloping to moderately sloping Thurman loamy fine sand. These are nearly level to moderately steep, deep soils on uplands, colluvial slopes, and stream terraces. The surface layer is fine sandy loam or loamy fine sand. The subsoil and underlying material range from clay loam to loamy fine sand. Soils in this windbreak suitability group have a moderate to high available water capacity, except the Thurman soils, which have a low available water capacity.

Windbreaks have a good chance for survival and growth if not subjected to drought or to excessive competition from weeds and grasses for the available moisture. Soil blowing can be prevented by maintaining strips of sod or other vegetation between the tree rows. Cultivation generally needs to be restricted to the tree rows. Erosion

TABLE 3.—*Relative vigor of trees grown in windbreaks and estimated average height attained in 20 years* [1]

Kind of tree	Silty to Clayey		Sandy		Very Sandy		Moderately Wet	
	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height	Relative vigor	Average height
		Feet		*Feet*		*Feet*		*Feet*
Eastern redcedar	Good	24	Good	23	Good	18	Good	23
Ponderosa pine	Good	28	Good	31	Good	26	Poor	(2)
Green ash	Good	26	Fair	29	Fair	23	Fair	29
Hackberry	Good	26	Fair	28	Fair	16	(3)	(3)
Honeylocust	Fair	33	Fair	31	Fair	16	Fair	35
Russian-olive	Fair	21	Fair	27	Fair	17	Poor	(2)
Russian mulberry	Fair	24	Fair	21	Fair	17	Fair	12
Eastern cottonwood	Poor	(2)	Fair	60	Fair	45	Fair	54

[1] Undesirable suitability group not included because the land type in this group is not suitable.
[2] Most trees of this species on soils of this group are dying.
[3] Insufficient data available.

by water can be a hazard where trees are planted on gently sloping to moderately steep soils.

Conifers suitable for planting are eastern redcedar, ponderosa pine, Austrian pine, and Scotch pine. Suitable deciduous trees are Russian mulberry, boxelder, honeylocust, and green ash. Shrubs that grow well are honeysuckle, skunkbush sumac, American plum, and autumn-olive.

VERY SANDY WINDBREAK SUITABILITY GROUP

This group consists of Valentine soils and the moderately sloping to moderately steep Thurman loamy fine sand. These are deep soils on broad, undulating uplands. The surface layer is loamy fine sand, and the underlying material is loamy fine sand or fine sand. Soils in this windbreak suitability group have rapid permeability and low available water capacity.

Only windbreaks of conifers have a good chance for survival and growth. Because the soil is so loose, trees should be planted in shallow furrows and the soil should not be cultivated. Soil blowing is a hazard. Young trees can be covered by drifting sand during periods of high winds.

Trees suitable for planting are conifers such as eastern redcedar, ponderosa pine, Scotch pine, and Austrian pine.

MODERATELY WET WINDBREAK SUITABILITY GROUP

This group consists of Colo, Fillmore, Lamo, McPaul, and Zook soils. These are nearly level, deep soils on bottom lands or in upland depressions. The water table is moderately high and flooding occurs occasionally. The surface layer, subsoil, and underlying material are silt loam, silty clay, or silty clay loam. Soils in this windbreak suitability group have a high available water capacity.

Windbreaks have a good chance for survival and growth if the trees are species that can tolerate occasional wetness. The establishment of trees can be difficult during wet years. The abundant and persistent herbaceous vegetation on these soils presents a competition problem and makes cultivation between tree rows hard to manage.

Conifers suitable for planting are eastern redcedar, Scotch pine, and Austrian pine. Suitable deciduous trees are Russian mulberry, honeylocust, green ash, hackberry, Eastern cottonwood, golden willow, white willow, black walnut, and sycamore. Shrubs that grow well are red-osier dogwood, buffaloberry, chokecherry, and purple willow.

UNDESIRABLE WINDBREAK SUITABILITY GROUP

Wet alluvial land is the only mapping unit in this group. This very poorly drained, nearly level, deep, loamy alluvium is on bottom lands. The water table is at a depth of 0 to 3 feet during most of the growing season, and ponding occurs during part of most years. This soil material has a high available water capacity.

Wet alluvial land generally is not suited to windbreak planting, but some areas can be used to provide habitat for wildlife. Trees and shrubs tolerant of high water can be planted by hand or planted when water is not ponded on the surface.

Management of the Soils for Wildlife [5]

The kinds and number of wildlife that can be produced and maintained in an area are determined largely by the kinds, amount, and distribution of vegetation. The vegetation, in turn, is governed by soil characteristics such as fertility, topography, permeability, and rate of water infiltration.

Fertile soils generally produce more food and habitat for wildlife than infertile soils, and water that has drained from fertile soils usually produces more fish and other aquatic life. Topography affects wildlife through its influence on how land can be used. Rough, steep land is a hazard to livestock and is unsuited to crop production; however, undisturbed vegetation on such land is valuable for wildlife and, where such cover is lacking, it often can be developed. Permeability and rate of water infiltration are important in the construction of ponds for fish and in developing and maintaining wetland habitat for waterfowl. Marsh areas are especially suited to the development of aquatic and semiaquatic habitat for waterfowl and some species of furbearers.

The capacity of an area for the production of wildlife is dependent on the habitat provided. However, because the better agricultural soils are intensively managed for maximum crop yields rather than for wildlife, those soils having the largest wildlife populations generally are not those having the highest potential for producing wildlife. When grasslands are plowed and the soil is used for crop production, there is a loss of cover for some kinds of animals but an improved food supply is made available for others. By protecting existing natural cover or by establishing needed cover, conditions can be improved for the production and maintenance of wildlife species. Planting trees and shrubs for field and farmstead windbreaks provides habitat for some kinds of wildlife. Construction of farm ponds provides additional opportunities for improving habitat for wildlife. Herbaceous and woody plantings around ponds supply cover for birds, game, and furbearing animals; and proper stocking and management of ponds can produce sustained annual crops of fish. Native vegetation on soils not suited for cultivation also can provide food and cover for wildlife.

The soils of Wayne County provide suitable habitats for many species of game and nongame birds and mammals. Table 4 shows the suitability of the soil associations for developing wildlife habitat and also gives the relative importance of three types of vegetation as food and cover for the principal kinds of game. The associations are rated *good*, *fair*, *poor*, or *very poor* with respect to their potential for producing the various kinds of vegetation needed by wildlife. The vegetative types are rated *high*, *medium*, or *low* with respect to their use by various kinds of game; those rated *high* or *medium* are considered essential to that species with respect to which they are rated. For descriptions of the associations and their location, reference should be made to the section "General Soil Map" in this survey. More detailed information on the kinds of vegetation that can be produced is given in the sections "Descriptions of the Soils" and "Use and Management of the Soils."

[5] By JAMES W. CARR, JR., forester, Soil Conservation Service.

TABLE 4.—*Potential of soil associations for wildlife habitat and importance of vegetative types as habitat for wildlife*

POTENTIAL FOR WILDLIFE HABITAT

Soil association	Woody plants	Herbaceous plants	Grain and seed crops	Aquatic habitat
Nora-Thurman	Good to fair	Good	Fair to very poor	
Nora-Moody	Good	Good	Good to fair	
McPaul-Lamo-Kennebec	Good	Good	Good to poor	Fair.
Moody-Nora-Judson	Good	Good	Good	
Nora-Crofton	Good to fair	Good	Good to poor	

IMPORTANCE OF VEGETATIVE TYPES TO WILDLIFE

Kind of wildlife	Woody plants		Herbaceous plants		Grain and seed crops	
	Food	Cover	Food	Cover	Food	Cover
Pheasant	Low	High	High	High	High	High.
Bobwhite quail	Low	High	High	High	High	Low.
Deer	High	High	Medium [1]	Low	High	Low.
Waterfowl					High [2]	

[1] Medium for white-tailed deer; high for mule deer.
[2] For dabbling ducks and geese, principally in spring and fall.

Some soils of the Nora-Thurman association are in native hayland and some are cultivated, but most are in native range or tame pasture and are used for grazing cattle. Where proper grazing management practices are observed, abundant cover provides good habitat, food, and cover for wildlife. The topography of this association provides sites for constructing dams, but the soils provide only a fair seal for ponds.

The gently sloping to moderately steep soils of the Nora-Moody association and the Moody-Nora-Judson association are on uplands and are used mostly for producing grain and seed crops. The cultivated fields generally are large, and areas producing permanent cover for wildlife are scarce. The crops, however, provide food for wildlife. Corn, sorghum, and alfalfa are excellent food for pheasant and quail. Undisturbed areas and roadsides provide most of the nesting habitat for pheasants. The topography of these associations provides sites for constructing dams and creating ponds, although sealing these ponds and maintaining a sufficient depth of water is sometimes difficult. Some of the existing ponds produce fish.

The wooded tracts along the streams and on bottom lands of the McPaul-Lamo-Kennebec association provide habitat for songbirds; for several kinds of game, including deer, bobwhite quail, squirrel, and cottontail rabbit; and for furbearers such as raccoon, opossum, and coyote. The streams and marsh areas are used by waterfowl, primarily during the spring and fall migration periods, and by mink, muskrat, and beaver. Deer Creek, Dog Creek, and Logan Creek provide bullheads and carp for stream fishing. Small farm ponds offer good fishing for bass, bluegill, channel catfish, northern pike, and bullhead.

The soils of the Nora-Crofton association are somewhat steeper than those of the other associations on the upland. Most of the gentle slopes are cultivated and provide an abundant supply of grain for wildlife. The steeper slopes are used for pasture and hay. Native grassland provides nesting habitat for wildlife.

Technical assistance in planning wildlife developments, including the proper location and the kinds of vegetation required, can be obtained from the Soil Conservation Service in Wayne, Nebraska. Additional information and assistance can be obtained from the Nebraska Game and Parks Commission, the U.S. Fish and Wildlife Service, and from the Agricultural Extension Service. The Soil Conservation Service also provides technical assistance in the planning and application of conservation practices for developing outdoor recreational facilities.

Engineering Uses of the Soils [6]

Information about soils used as structural material or as foundations upon which structures are built is of special interest to engineers, contractors, planning commissions, town and city managers, land developers, and farmers. Among the properties of soils most important in engineering are permeability, shear strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are topography, depth to the water table, and depth to bedrock or to sand and gravel. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Engineering properties determined by laboratory tests are given for samples from five soil profiles in table 5. Estimated soil properties significant to engineering and interpretations for various engineering uses are given for all soils in Wayne County in tables 6 and 7, respectively.

[6] By F. STEWART BOHRER, area engineer, and DONALD E. KERL, soil scientist, Soil Conservation Service.

TABLE 5.—*Engineering test*

[Tests performed by the Nebraska Department of Roads in accordance with standard

Soil name and location	Parent material	Report No.	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lbs. per cu. ft.*	*Percent*
Colo silty clay loam: 800 feet W. and 63 feet N. of SE. corner of sec. 21, T. 25 N., R. 2 E. (modal profile).	Loamy and clayey alluvium.	S68-2258	0–7	----------	----------
		S68-2259	24–36	----------	----------
		S68-2260	40–44	----------	----------
Crofton silt loam: 1,470 feet S. and 150 feet E. of NW. corner of sec. 2, T. 25 N., R. 1 E. (modal profile).	Peoria loess.	S68-2264	0–7	----------	----------
		S68-2265	12–17	----------	----------
		S68-2266	25–60	----------	----------
Kennebec silt loam: 528 feet N. and 100 feet W. of SE. corner of sec. 6, T. 26 N., R. 3 E. (modal profile).	Silty alluvium.	S68-2261	0–6	----------	----------
		S68-2262	16–25	----------	----------
		S68-2263	49–62	----------	----------
Moody silty clay loam: 528 feet W. and 70 feet N. of SE. corner of sec. 26, T. 26 N., R. 4 E. (subsoil finer textured than subsoil of modal soil).	Peoria loess.	S31119	0–6	95	25
		S31120	20–30	101	20
		S31121	48–60	105	20
Nora silt loam [5]: 400 feet W. and 200 feet N. of SE. corner of sec. 26, T. 26 N., R. 4 E. (modal profile).	Peoria loess.	S31122	0–6	99	22
		S31123	11–18	107	19
		S31124	45–60	106	19

[1] Based on AASHO Designation T99, Method A (*1*).
[2] According to AASHO Designation T88-47 (*1*). Results by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material including that coarser than 2 millimeters in diameter. In the SCS procedure, the fine material is analyzed by the pipette method and the material coarser than 2 milli-

The estimates and interpretations in these tables can be helpful to those who—

1. Select potential residential, industrial, commercial, or recreational areas;
2. Evaluate alternate routes for roads, highways, pipelines, or underground cables;
3. Seek sources of gravel, sand, or clay;
4. Plan farm drainage systems, irrigation systems, ponds, terraces, or other structures for controlling water and conserving soil;
5. Correlate performance of engineering structures already built with the properties of the soils on which they are built and thus develop information for predicting performance of structures on the same or similar kinds of soils in other locations;
6. Predict the suitability of soils for cross-country movement of vehicles or construction equipment; and
7. Develop preliminary estimates pertinent to construction in a particular area.

The engineering interpretations in this survey, used in conjunction with the soil map, serve many useful purposes. It should be emphasized, however, that they do not eliminate the need for detailed field investigations at sites for specific engineering works. Sampling and testing are particularly important where construction involves heavy loads or excavations deeper than the depths reported, generally about 5 feet. Also, inspection of sites, especially the smaller ones, is needed because delineated areas of many soil mapping units contain small areas of other soils that have strongly contrasting properties and different suitabilities or limitations for soil engineering. The soils of Wayne County are deep enough that bedrock does not affect their use.

Some of the terms used by soil scientists may be unfamiliar to engineers and some words—for example, clay, sand, and silt—have special meaning in soil science. These and other special terms used in this survey are defined in the Glossary.

Engineering classification systems

The two systems most widely used for classifying soils for engineering purposes are the American Association of State Highway Officials system (AASHO) (*1*) and the Unified soil classification system (USCS) (*8*). The latter was developed by the U.S. Army Corps of Engineers, U.S. Department of Defense, and is used by many organizations, including the Soil Conservation Service, Bureau of Reclamation, and Corps of Engineers. Estimated classifications of all the soils in Wayne County according to these two systems and according to the textural classification used by the U.S. Department of Agriculture (USDA) (*4*) are given in table 6.

Classification in the AASHO system is based on field performance. In this system soil materials are placed in seven groups, ranging from A-1 (soils that have a high

data for five soil profiles

procedure of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage less than 3 inches passing sieve—					Percentage smaller than—							
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
									Percent			
			100	98	94	76	46	38	50	22	A–7–6(15)	ML–CL
			100	99	93	59	38	31	46	27	A–7–6(16)	CL
			100	99	94	66	44	33	54	32	A–7–6(19)	CH
		100	99	98	92	58	38	25	42	20	A–7–6(12)	CL
			100	99	94	58	36	26	43	22	A–7–6(13)	CL
				100	92	54	33	22	39	19	A–6(12)	CL
			100	98	91	62	36	24	48	21	A–7–6(14)	CL–ML
			100	99	93	51	30	22	38	14	A–6(10)	CL–ML
			100	98	94	61	36	23	44	23	A–7–6(14)	CL
			100	99	96	68	44	39	44	17	A–7–6(12)	ML–CL
				100	97	72	46	40	54	29	A–7–6(18)	CH
			100	99	96	66	39	34	42	20	A–7–6(12)	CL
			100	99	97	67	42	35	44	18	A–7–6(12)	CL–ML
100	99	96	96	96	93	66	40	33	43	18	A–7–6(12)	CL–ML
			100	99	97	67	35	31	38	15	A–6(10)	CL–ML

meters in diameter is excluded from calculation of grain-sized fractions. The mechanical analyses in this table are not suitable for use in naming textural classes for soils.

[3] Based on AASHO Designation M 145–49 (*1*).

[4] Based on Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations. MIL-STD-619B (*8*).

[5] Texture grades to silty clay loam.

bearing capacity) to A–7 (soils that have a low bearing capacity when wet). A–1, A–2, and A–3 soils are predominantly sand and gravel mixtures, and A–4 through A–7 soils are mostly silt and clay mixtures. A sand-silt-clay soil is further classified by identifying the silt-clay portion. Thus, an A–2–4 soil is an A–2 sand with an A–4 type of silt-clay mixture included. The relative engineering values of each soil within the group are indicated by a group index number, which is shown in parentheses after the soil group (see table 6). Group index numbers, which rate the field performance of the soil, range from 0 for the best material to 20 for the poorest. The Nebraska Department of Roads uses group index numbers ranging from −4 to 32 instead of 0 to 20; ratings less than 0 evaluate the plastic and nonplastic fine-grained soil occurring in sands, and ratings greater than 20 show the effect of a high clay content.

The Unified classification system is based on the texture and plasticity of the soils as well as on their performance as engineering construction material. Each classification consists of two letters that represent the principal characteristics of the soil. The first letter indicates whether the soil is coarse grained, fine grained, or organic (or peat). The coarse-grained soils are gravel, G, and sand, S. These are further classified primarily by gradation: W for well graded and P for poorly graded; for example, SP is a sand, poorly graded. The fine-grained soils are silt, M, and clay, C. These are further classified according to plasticity characteristics: L for low liquid limit and H for high liquid limit; therefore, CL is a clay of low plasticity. Organic soils, O, and peat, Pt, are classified according to odor and to plasticity changes after oven-drying. Soils that have borderline characteristics of two classifications are given a dual classification. Tables 5 and 6 show that the soils of Wayne County are classified as SP, SP–SM, SM, SC, ML, ML–CL, CL, and CH. Organic (OL and OH) and peat (Pt) soils are uncommon in Nebraska.

Many soil scientists use the USDA textural classification. In this system, the texture of soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter; that is, the proportion of sand, silt, and clay. Textural modifiers, such as gravelly, stony, shaly, and cobbly, are used as needed.

Engineering test data

Table 5 shows engineering test data for 15 samples of 5 soils that were tested by the Division of Materials and Tests, Nebraska Department of Roads, according to standard AASHO procedures. Each soil was sampled at only one location, and the data given for the soil are those for that location. From one location to another, a soil can differ considerably in characteristics that affect engineering. Even when soils are sampled at more than one location, the test data probably do not show the widest range in characteristics.

The engineering classifications in the last two columns of table 5 are based on data obtained by mechanical analysis and on tests to determine the liquid and plastic limits.

TABLE 6.—*Estimated engineering*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
*Belfore: BeA, BmB	>10	0–11	Silty clay loam	ML or CL	A–6
For properties of Moody part of unit BmB, refer to Moody units MoC, MoD, and MoD2 in this table.		11–45	Silty clay loam or silty clay.	CL or CH	A–7
		45–60	Silt loam	CL	A–6
Blendon: BnC	>10	0–17	Fine sandy loam	SM or ML	A–4
		17–54	Fine sandy loam	SM	A–2 or A–4
		54–60	Silty clay	CH	A–7
*Colo:					
Ca	[2] 3–6	0–16	Silt loam	ML	A–6 or A–7
		16–48	Silty clay loam	CL	A–6 or A–7
		48–60	Silty clay loam	CH	A–7
Cb, Cc	8–12	0–26	Silty clay loam	ML, CL, or CH	A–7 or A–6
For Lamo part of unit Cc, see Lamo unit Lb. Depth to water table in unit Lb is 2 to 5 feet.		26–36	Silty clay loam	CL	A–7 or A–6
		36–60	Silty clay loam	CH	A–7
Crofton: CfC2, CfD2, CfE2	>10	0–7	Silt loam	CL	A–6 or A–7
		7–17	Silt loam	CL	A–6 or A–7
		17–60	Silt loam	CL	A–6
Fillmore: Fm	[2] >10	0–12	Silt loam	ML	A–4
		12–26	Silt loam	ML or CL	A–4 or A–6
		26–60	Silty clay or silty clay loam.	CH or CL	A–7 or A–6
*Hadar: HtE	>10	0–23	Loamy fine sand	SM	A–2
For properties of Thurman part of this unit, see Thurman unit TsC.		23–28	Loam	ML–CL	A–7
		28–60	Clay loam	CL	A–6 or A–7
Judson: JuC	>10	0–16	Silt loam	ML or CL	A–6 or A–7
		16–29	Silty clay loam	ML or CL	A–7
		29–60	Silty clay loam	CL or CH	A–7
Kennebec: Ke	8–12	0–16	Silt loam	ML or CL	A–7
		16–36	Silt loam	ML or CL	A–6 or A–7
		36–60	Silt loam or silty clay loam.	CL	A–7
Lamo:					
La	[2] 2–6	0–9	Silt loam	ML	A–6 or A–7
		9–32	Silty clay loam	CL	A–7 or A–6
		32–60	Silty clay loam	CL or CH	A–7
Lb	2–6	0–28	Silty clay loam	ML–CL	A–7
		28–43	Silty clay loam	CL	A–7
		43–60	Silty clay loam	CL or CH	A–7
Loretto: LvA	>10	0–11	Fine sandy loam	CL or SC	A–6 or A–4
		11–18	Silty clay loam	CL	A–7 or A–6
		18–60	Silt loam	ML or CL	A–6
McPaul:					
Mc, Md	[2] 8–12	0–16	Silt loam	ML	A–6 or A–7
Depth to water table in unit Md is 2 to 6 feet.		16–49	Silt loam	ML	A–7 or A–6
		49–60	Silt loam	ML or CL	A–7

See footnotes at end of table.

properties of the soils

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for table. Symbol > means more than; symbol < means less than]

Percentage less than 3 inches passing sieve—			Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
			Percent		*Inches per hour*	*Inches per inch of soil*	*pH*	
	100	95–100	35–45	15–25	0.2–0.6	0.21–0.23	6.1–7.3	Moderate.
	100	95–100	45–55	20–30	0.2–0.6	0.18–0.20	6.6–7.3	Moderate to high.
	100	95–100	40–50	20–30	0.6–2.0	0.20–0.22	6.6–7.3	Moderate.
100	95–100	40–60	15–25	0–10	2.0–6.0	0.16–0.18	6.6–7.3	Low.
100	85–90	30–40	[1] NP	[1] NP	2.0–6.0	0.15–0.17	6.6–7.3	Low.
	100	95–100	55–75	30–50	0.06–0.2	0.10–0.12	6.6–7.3	High.
	100	95–100	35–45	10–20	0.6–2.0	0.22–0.24	6.6–7.8	Moderate.
	100	95–100	40–45	25–35	0.2–0.6	0.18–0.20	6.6–7.8	Moderate.
	100	95–100	50–55	30–35	0.2–0.6	0.18–0.20	7.4–8.4	Moderate to high.
	100	95–100	45–55	20–25	0.2–0.6	0.21–0.23	6.6–7.8	Moderate.
	100	95–100	40–45	25–35	0.2–0.6	0.18–0.20	6.6–7.8	Moderate.
	100	95–100	50–55	30–35	0.2–0.6	0.18–0.20	7.4–8.4	Moderate to high.
	100	95–100	35–45	10–25	0.6–2.0	0.22–0.24	7.9–8.4	Moderate.
	100	95–100	35–45	15–30	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.
	100	95–100	30–45	10–25	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.
	100	95–100	15–35	5–15	0.6–2.0	0.22–0.24	6.1–7.3	Moderate.
	100	95–100	15–30	0–10	0.6–2.0	0.20–0.22	6.6–7.3	Moderate.
	100	95–100	40–60	25–35	<0.06	0.10–0.12	6.6–7.8	Moderate to high.
100	80–90	13–30	[1] NP	[1] NP	6.0–20.0	0.10–0.12	6.1–7.3	Low.
	100	55–75	35–45	10–20	0.6–2.0	0.17–0.19	6.6–7.3	Low.
100	95–100	75–95	40–50	20–35	0.2–0.6	0.14–0.16	6.6–8.4	Moderate to high.
	100	95–100	30–45	10–20	0.6–2.0	0.22–0.24	6.6–7.3	Moderate.
	100	95–100	35–50	10–20	0.6–2.0	0.18–0.20	6.6–7.3	Moderate to high.
	100	95–100	40–60	20–35	0.6–2.0	0.18–0.20	6.6–7.3	Moderate to high.
	100	95–100	35–50	10–30	0.6–2.0	0.22–0.24	6.6–7.3	Moderate.
	100	95–100	30–45	10–25	0.6–2.0	0.20–0.22	6.6–7.3	Moderate.
	100	95–100	30–50	20–35	0.6–2.0	0.20–0.22	6.6–7.3	Moderate to high.
	100	95–100	35–45	5–15	0.6–2.0	0.22–0.24	7.4–7.8	Moderate.
	100	95–100	40–50	20–35	0.2–0.6	0.18–0.20	7.9–8.4	Moderate to high.
	100	95–100	45–55	25–40	0.2–0.6	0.18–0.20	7.4–7.8	Moderate to high.
	100	95–100	40–50	15–25	0.2–0.6	0.21–0.23	7.4–7.8	Moderate to high.
	100	95–100	40–50	20–35	0.2–0.6	0.18–0.20	7.9–8.4	Moderate to high.
	100	95–100	45–55	25–40	0.2–0.6	0.18–0.20	7.4–7.8	Moderate to high.
	100	45–55	20–30	10–15	2.0–6.0	0.16–0.18	6.6–7.8	Low.
	100	95–100	30–45	10–25	0.6–2.0	0.18–0.20	6.6–7.8	Moderate.
	100	95–100	30–45	10–20	0.6–2.0	0.20–0.22	7.9–8.4	Moderate.
	100	95–100	35–50	5–25	0.6–2.0	0.22–0.24	7.4–8.4	Moderate.
	100	95–100	35–48	10–25	0.6–2.0	0.20–0.22	7.4–7.8	Moderate.
	100	95–100	35–48	10–25	0.6–2.0	0.20–0.22	7.4–7.8	Moderate.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
*Moody:					
MhC	>10	0–11	Silt loam	ML or CL	A–7 or A–6
		11–36	Silty clay loam or silt loam.	ML or CL	A–7 or A–6
		36–60	Silt loam	ML or CL	A–6 or A–7
MoC, MoD, MoD2	>10	0–11	Silty clay loam	ML or CL	A–7 or A–6
		11–42	Silty clay loam	CH or CL	A–7
		42–60	Silt loam or silty clay loam.	CL	A–7 or A–6
MrC, MrD. For properties of Nora part of these units, see the data given under Nora series for Nora part of units MrC and MrD.	>10	0–10	Fine sandy loam	CL or SC	A–6 or A–4
		10–18	Silty clay loam	CL	A–7 or A–6
		18–60	Silt loam	ML or CL	A–6
*Nora:					
NoC2, NoD2, NoE2	>10	0–7	Silt loam	ML or CL	A–7 or A–6
		7–31	Silt loam	ML or CL	A–7 or A–6
		31–60	Silt loam	CL	A–6
NrD, NrE. For properties of the Moody part of these units, see Moody unit MoC.	>10	0–10	Silty clay loam	ML–CL	A–7 or A–6
		10–36	Silty clay loam or silt loam.	ML–CL	A–7 or A–6
		36–60	Silt loam	ML–CL	A–6
Nora part of Moody units MrC and MrD	>10	0–10	Fine sandy loam	ML–CL or SM–SC	A–6 or A–4
		10–18	Silt loam	ML or CL	A–6
		18–60	Silt loam	ML or CL	A–6
Ortello: OrC, OrD	>10	0–13	Fine sandy loam	SM	A–2 or A–4
		13–25	Fine sandy loam	SM	A–2 or A–4
		25–60	Loamy fine sand or fine sand.	SM	A–2
Thurman:					
ThC, ThE	>10	0–16	Loamy fine sand	SM	A–2
		16–25	Loamy fine sand	SM	A–2
		25–60	Fine sand	SP–SM or SM	A–3 or A–2
TsC	>10	0–16	Loamy fine sand	SM	A–2
		16–40	Loamy fine sand or fine sandy loam.	SM	A–2 or A–4
		40–60	Silty clay loam	CL	A–6 or A–7
Valentine: VbE	>10	0–7	Loamy fine sand	SP–SM or SM	A–2 or A–3
		7–60	Fine sand	SP or SP–SM	A–3
Wet alluvial land: Wx	0–3	0–28	Silty clay loam	ML–CL	A–7
		28–43	Silty clay loam	CL	A–7
		43–60	Silty clay loam	CL or CH	A–7
Zook: Zo	3–8	0–22	Silty clay loam	CL or CH	A–7
		22–30	Silty clay	CH	A–7
		30–43	Silty clay loam	CL or CH	A–7
		43–60	Silty clay	CH	A–7

[1] Nonplastic.

properties of the soils—Continued

Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Shrink-swell potential
			Percent		*Inches per hour*	*Inches per inch of soil*	*pH*	
------------	100	85–100	35–45	10–25	0. 6–2. 0	0. 22–0. 24	6. 6–7. 3	Low to moderate.
------------	100	95–100	35–45	10–25	0. 2–0. 6	0. 18–0. 20	6. 6–7. 3	Moderate.
------------	100	95–100	35–45	5–15	0. 6–2. 0	0. 20–0. 22	7. 4–7. 8	Low to moderate.
------------	100	95–100	30–50	10–25	0. 2–0. 6	0. 21–0. 23	6. 6–7. 3	Moderate.
------------	100	95–100	50–60	25–35	0. 2–0. 6	0. 18–0. 20	6. 6–7. 3	Moderate to high.
------------	100	95–100	25–50	20–35	0. 2–0. 6	0. 18–0. 20	7. 4–7. 8	Moderate to high.
------------	100	45–55	20–40	5–15	2. 0–6. 0	0. 16–0. 18	6. 6–7. 3	Low.
------------	100	95–100	35–45	10–30	0. 2–0. 6	0. 18–0. 20	6. 6–7. 3	Moderate.
------------	100	95–100	30–45	10–20	0. 6–2. 0	0. 20–0. 22	7. 4–7. 8	Moderate.
------------	100	95–100	35–45	10–25	0. 6–2. 0	0. 22–0. 24	7. 4–7. 8	Moderate.
------------	100	95–100	35–45	10–25	0. 6–2. 0	0. 20–0. 22	7. 9–8. 4	Moderate.
------------	100	95–100	30–45	10–25	0. 6–2. 0	0. 20–0. 22	7. 9–8. 4	Moderate.
------------	100	95–100	30–50	15–30	0. 6–2. 0	0. 21–0. 23	6. 6–7. 3	Moderate.
------------	100	95–100	30–50	15–30	0. 6–2. 0	0. 18–0. 20	6. 6–8. 4	Moderate.
------------	100	95–100	30–45	10–20	0. 6–2. 0	0. 18–0. 20	7. 9–8. 4	Moderate.
------------	100	45–55	20–40	5–20	2. 0–6. 0	0. 16–0. 18	6. 6–7. 3	Low.
------------	100	95–100	35–45	10–25	0. 6–2. 0	0. 20–0. 22	7. 4–7. 8	Moderate.
------------	100	95–100	30–42	10–20	0. 6–2. 0	0. 20–0. 22	7. 9–8. 4	Moderate.
100	85–90	30–40	15–25	0–10	2. 0–6. 0	0. 16–0. 18	6. 1–7. 3	Low.
100	85–90	30–40	[1] NP	[1] NP	2. 0–6. 0	0. 15–0. 17	6. 6–7. 3	Low.
100	85–90	13–35	[1] NP	[1] NP	2. 0–6. 0	0. 08–0. 10	6. 6–7. 3	Very low.
100	85–90	15–30	[1] NP	[1] NP	6. 0–20. 0	0. 10–0. 12	6. 1–6. 5	Low.
100	95–90	15–30	[1] NP	[1] NP	6. 0–20. 0	0. 09–0. 11	6. 6–7. 3	Low.
100	85–90	5–15	[1] NP	[1] NP	6. 0–20. 0	0. 05–0. 07	6. 6–7. 3	Very low.
100	85–90	13–30	[1] NP	[1] NP	6. 0–20. 0	0. 10–0. 12	6. 1–6. 5	Low.
100	85–90	30–40	15–25	0–10	2. 0–6. 0	0. 15–0. 17	6. 6–7. 3	Low.
------------	100	95–100	35–45	15–25	0. 6–2. 0	0. 18–0. 20	6. 6–7. 3	Moderate.
100	85–90	5–15	[1] NP	[1] NP	6. 0–20. 0	0. 10–0. 12	6. 1–6. 5	Very low.
100	85–90	5–10	[1] NP	[1] NP	6. 0–20. 0	0. 05–0. 07	6. 1–7. 3	Very low.
------------	100	95–100	40–50	15–25	0. 2–0. 6	0. 21–0. 23	7. 4–7. 8	Moderate to high.
------------	100	95–100	40–50	20–35	0. 2–0. 6	0. 18–0. 20	7. 9–8. 4	Moderate to high.
------------	100	95–100	45–55	25–40	0. 2–0. 6	0. 18–0. 20	7. 4–7. 8	Moderate to high.
------------	100	95–100	45–55	25–40	0. 2–0. 6	0. 21–0. 23	6. 1–6. 5	Moderate to high.
------------	100	95–100	55–75	30–50	0. 06–0. 2	0. 11–0. 13	6. 1–6. 5	High.
------------	100	95–100	45–55	25–40	0. 2–0. 6	0. 18–0. 20	6. 6–7. 3	Moderate to high.
------------	100	95–100	55–75	30–50	0. 06–0. 2	0. 10–0. 12	6. 6–7. 3	High.

[2] Soil is subject to flooding.

TABLE 7.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The soils in such mapping units may have

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Foundations	Sanitary land fill [1]	Local roads and streets
*Belfore: BeA, BmB. For Moody part of unit BmB, refer to Moody units MoC, MoD, and MoD2.	Severe: moderately slow permeability.	Slight	Slight	Slight to moderate	Moderate: clayey soil texture.	Severe: high shrink-swell potential.
Blendon: BnC	Slight: possibility of seepage into ground water.	Severe: moderately rapid permeability.	Slight: possible caving.	Slight: needs compaction in places.	Slight above the plastic subsoil; depth to plastic subsoil is variable.	Slight: for construction; erodible by wind and water.
*Colo:						
Ca	Severe: subject to flooding; moderately slow permeability; water table at depth of 2 to 8 feet.	Severe: subject to flooding; water table at depth of 2 to 8 feet.	Severe: subject to flooding; water table at depth of 2 to 8 feet.	Severe: subject to flooding; water table at depth of 2 to 8 feet.	Moderate to severe: somewhat poorly drained; slight flooding hazard.	Severe: subject to flooding and frost heave; plasticity index of subgrade material is more than 15.
Cb	Severe: water table at depth of 8 to 12 feet.	Slight	Moderate: water table at depth of 8 to 12 feet.	Moderate: moderate shrink-swell potential.	Moderate to severe: water table at depth of 8 to 12 feet; slight flooding hazard.	Severe: plasticity index of subgrade material is more than 15.
Cc. For Lamo part of this unit, refer to Lamo unit Lb.	Severe: moderately slow permeability; water table at depth of 2 to 8 feet.	Moderate: water table at depth of 2 to 8 feet.	Severe: somewhat poorly drained; water table at depth of 2 to 8 feet.	Moderate: somewhat poorly drained; moderate shrink-swell potential.	Moderate to severe: somewhat poorly drained; slight flooding hazard.	Severe: subject to frost heave; plasticity index of subgrade material is more than 15.
Crofton:						
CfC2	Slight	Moderate: 2 to 7 percent slopes; moderate permeability.	Slight: foundation subject to consolidation.	Moderate: foundation subject to consolidation.	Slight: slopes too steep in places.	Moderate: subject to erosion; plasticity index of subgrade material is more than 15.
CfD2	Moderate: 7 to 11 percent slopes.	Severe: 7 to 11 percent slopes.	Moderate: 7 to 11 percent slopes.	Moderate: moderate shrink-swell potential; 7 to 11 percent slopes.	Slight: 7 to 11 percent slopes.	Moderate: subject to erosion; plasticity index of subgrade material is more than 15.
CfE2	Moderate to severe: 11 to 20 percent slopes.	Severe: 11 to 20 percent slopes.	Severe: 11 to 20 percent slopes.	Moderate to severe: moderate shrink-swell potential; 11 to 20 percent slopes.	Slight: 11 to 20 percent slopes.	Moderate: subject to erosion; plasticity index of subgrade material is more than 15.
Fillmore: Fm	Severe: subject to flooding; very slow permeability.	Severe: subject to flooding.	Severe: poorly drained; subject to flooding; silty clay subsoil.	Severe: poorly drained; subject to flooding; moderate to high shrink-swell potential.	Severe: subject to flooding; clayey texture.	Severe: poorly drained; subject to flooding and frost heave; plasticity index of subgrade material is more than 15.
*Hadar: HtE. For Thurman part of this unit, refer to Thurman unit TsC.	Severe: moderately slow permeability in lower part; 5 to 15 percent slopes.	Moderate to severe: moderately slow permeability in lower part; 5 to 15 percent slopes.	Moderate: 5 to 15 percent slopes.	Severe: moderate to high shrink-swell potential.	Slight: 5 to 15 percent slopes.	Severe: plasticity index of subgrade material is more than 15.
Judson: JuC	Moderate to severe: moderate permeability.	Slight	None to slight	Moderate: moderate to high shrink-swell potential.	Slight	Severe: moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15.

See footnotes at end of table.

engineering properties of the soils

different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Suitability as source of—			Soil features affecting—				
Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	Terraces and diversion
Poor: high shrink-swell potential; lime stabilization needed in places.	(2)	Fair: silty clay loam texture.	Low seepage; moderately slow permeability.	Fair compaction characteristics and stability.	Drainage not needed.	Slow intake rate; high available water capacity.	Terraces and diversions not needed.
Good: maintains good drainage.	Poor: many fines in soil material.	Good at surface; fair below depth of 1.5 feet; erodible.	High seepage	Good stability; subject to seepage.	Drainage not needed.	Rapid infiltration	Sandy substratum within 3 feet of surface.
Poor: moderate to high shrink-swell potential; Unified soil class CL or CH.	(2)	Fair: poor workability below depth of 1.5 feet.	Low seepage; water table at depth of 2 to 8 feet.	Fair compaction characteristics and stability.	Moderately slow permeability; subject to flooding; water table at depth of 2 to 8 feet.	Moderately slow permeability; subject to flooding; water table at depth of 2 to 8 feet.	Terraces and diversions not needed.
Poor: moderate to high shrink-swell potential; Unified soil class CL or CH.	(2)	Fair: poor workability below depth of 1.5 feet.	Low seepage; moderately slow permeability.	Fair compaction characteristics and stability.	Moderately slow permeability; water table at depth of 8 to 12 feet.	Moderately slow permeability; high available water capacity.	Terraces and diversions not needed.
Poor: moderate to high shrink-swell potential; Unified soil class CL or CH.	(2)	Fair: poor workability below depth of 1.5 feet.	Low seepage; water table at depth of 2 to 8 feet.	Fair compaction characteristics and stability.	Moderately slow permeability; water table at depth of 2 to 8 feet.	Moderately slow permeability; water table at depth of 2 to 8 feet.	Terraces and diversions not needed.
Poor: plasticity index of subgrade material is more than 15.	(2)	Fair to poor: suitable material is less than 8 inches thick.	Moderate seepage; sealing or lining necessary.	Good compaction characteristics and stability.	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible; short irregular slopes.
Poor: plasticity index of subgrade material is more than 15.	(2)	Fair to poor: suitable material is less than 8 inches thick.	Moderate seepage; sealing or lining necessary.	Good compaction characteristics and stability.	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible; short irregular slopes.
Poor: plasticity index of subgrade material is more than 15.	(2)	Fair to poor: suitable material is less than 8 inches thick.	Moderate seepage; sealing or lining necessary.	Good compaction characteristics and stability.	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible; short irregular slopes.
Poor: poorly drained; moderate shrink-swell potential; plasticity index of subgrade material is more than 15.	(2)	Fair to poor: poorly drained; poor workability below depth of 2 feet.	Low seepage; very slow permeability.	Fair to poor compaction characteristics and stability.	Subject to ponding; very slow permeability; adequate outlets not available in places.	Very slow permeability.	Terraces and diversions not needed.
Poor: moderate to high shrink-swell potential in lower part; plasticity of subgrade material is more than 15.	(2)	Fair: poor workability below depth of 2 feet; 5 to 15 percent slopes.	Low seepage; moderately slow permeability below depth of 2 feet.	Fair to good compaction characteristics and stability.	Drainage not needed.	5 to 15 percent slopes.	Erodible; includes rocks in places.
Poor: moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15.	(2)	Fair: silty clay loam texture.	Low seepage; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity.	Erodible.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Foundations	Sanitary land fill [1]	Local roads and streets
Kennebec: Ke	Moderate: moderate permeability.	Slight	None to slight	Moderate: moderate shrink-swell potential.	Slight: must be protected from flooding; water table at depth of 8 to 12 feet.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in some places.
Lamo:						
La	Severe: moderately slow permeability; subject to flooding; water table at depth of 2 to 10 feet.	Severe: water table at depth of 2 to 10 feet.	Severe: somewhat poorly drained; water table at depth of 2 to 10 feet.	Severe: subject to flooding; moderate to high shrink-swell potential.	Moderate to severe: somewhat poorly drained; water table at depth of 2 to 10 feet.	Severe: subject to flooding and frost heave; plasticity index of subgrade material is more than 15.
Lb	Severe: moderately slow permeability; water table at depth of 2 to 10 feet.	Severe: water table at depth of 2 to 10 feet.	Severe: somewhat poorly drained; water table at depth of 2 to 10 feet.	Moderate: somewhat poorly drained; moderate to high shrink-swell potential.	Moderate to severe: somewhat poorly drained.	Severe: subject to frost heave; moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15.
Loretto: LvA	Moderate to severe: moderate permeability.	Moderate: moderate permeability.	None to slight	Moderate: moderate shrink-swell potential.	Slight	Moderate: moderate shrink-swell potential.
McPaul:						
Mc	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding; water table at depth of 8 to 12 feet.	Severe: subject to flooding.
Md	Severe: subject to flooding; water table at depth of 2 to 10 feet.	Severe: subject to flooding; water table at depth of 2 to 10 feet.	Severe: subject to flooding; water table at depth of 2 to 10 feet.	Severe: poorly drained; water table at depth of 2 to 10 feet.	Moderate: subject to flooding; water table at depth of 2 to 10 feet.	Severe: poorly drained; subject to flooding and frost heave.
*Moody:						
MhC	Severe or moderate: moderately slow permeability; friable material below a depth of 36 inches.	Slight: moderate permeability.	None to slight	Moderate: moderate shrink-swell potential.	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.
MoC, MoD, MoD2	Severe or moderate: moderately slow permeability; friable material below a depth of 42 inches; 7 to 11 percent slopes (MoD and MoD2).	Moderate to severe: 7 to 11 percent slopes (MoD and MoD2).	Slight	Moderate: moderate shrink-swell potential; 7 to 11 percent slopes (MoD and MoD2).	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places; slopes erodible.
MrC, MrD. For Nora part of these units, refer to data given for them under Nora series.	Severe or moderate: moderately slow permeability; friable material below a depth of 18 inches; 5 to 11 percent slopes (MrD).	Moderate to severe: 5 to 11 percent slopes (MrD).	Slight	Moderate: moderate shrink-swell potential; 5 to 11 percent slopes (MrD).	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places; slopes erodible.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	Terraces and diversion
Poor: moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15 in some places.	(2)	Good	Low seepage; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity.	Terraces and diversions not needed.
Poor: moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15.	(2)	Fair to poor: silty clay loam texture.	Moderately slow permeability; water table at depth of 2 to 10 feet.	Fair to poor compaction characteristics and stability.	Subject to flooding; water table at depth of 2 to 10 feet.	Subject to flooding; water table at depth of 2 to 10 feet.	Terraces and diversions not needed.
Poor: moderate to high shrink-swell potential; plasticity index of subgrade material is more than 15.	(2)	Fair to poor: water table at depth of 2 to 10 feet.	Moderately slow permeability; water table at depth of 2 to 10 feet.	Fair to poor compaction characteristics and stability.	Water table at depth of 2 to 10 feet.	Moderately slow permeability; water table at depth of 2 to 10 feet.	Terraces and diversions not needed.
Fair: moderate shrink-swell potential.	(2)	Good to fair workability.	Moderate seepage and permeability.	Good compaction characteristics and stability.	Drainage not needed.	Moderate permeability; moderately rapid intake rate in surface layer.	Terraces and diversions not needed.
Fair: moderate shrink-swell potential.	(2)	Good	Moderate seepage and permeability; subject to flooding.	Fair compaction characteristics and stability.	Subject to flooding; surface drainage needed in places.	Subject to flooding; high available water capacity; moderate permeability.	Potential for siltation behind diversions.
Poor: water table at depth of 2 to 10 feet.	(2)	Fair to poor: water table at depth of 2 to 10 feet.	Water table at depth of 2 to 10 feet.	Fair compaction characteristics and stability; borrow soils difficult to excavate in places.	Subject to flooding; water table at depth of 2 to 10 feet.	Water table at depth of 2 to 10 feet.	Terraces not needed; potential for siltation behind diversions.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Good to depth of 11 inches.	Low seepage if compacted or sealed; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Fair: silty clay loam texture.	Low seepage if compacted or sealed; moderate permeability; 7 to 11 percent slopes (MoD and MoD2).	Fair compaction characteristics and stability; 7 to 11 percent slopes (MoD and MoD2).	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible; short irregular slopes.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Good to depth of 10 inches.	Low seepage if compacted or sealed; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity; steeper slopes erodible.	Erodible; short irregular slopes.

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TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Foundations	Sanitary land fill[1]	Local roads and streets
*Nora:						
NoC2	Moderate: moderate permeability.	Moderate: moderate permeability.	None to slight	Moderate: moderate shrink-swell potential.	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.
NoD2, NoE2	Moderate: moderate permeability; 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Severe: 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Moderate: 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Moderate to severe: 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places; 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).
NrD, NrE (For Moody part of these units, refer to Moody unit MoC.)	Moderate: moderate permeability; 7 to 11 percent slopes (NrD) and 11 to 17 percent slopes (NrE).	Severe: 7 to 11 percent slopes (NrD) and 11 to 17 percent slopes (NrE).	Moderate: 7 to 11 percent slopes (NrD) and 11 to 17 percent slopes (NrE).	Moderate to severe: 7 to 11 percent slopes (NrD) and 11 to 17 percent slopes (NrE).	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places; 7 to 11 percent slopes (NrD) and 11 to 17 percent slopes (NrE).
Nora part of MrC and MrD	Moderate: moderate permeability; 5 to 11 percent slopes (MrD).	Severe: 5 to 11 percent slopes (MrD).	Moderate: 5 to 11 percent slopes (MrD).	Moderate to severe: 5 to 11 percent slopes (MrD).	Slight: all-weather access road needed.	Moderate: moderate shrink-swell potential; plasticity index of subgrade material is more than 15; 5 to 11 percent slopes (MrD).
Ortello:						
OrC	Slight: contamination of ground water a possible hazard.[3]	Severe: moderately rapid permeability.	Slight: danger of caving.	Slight: needs compaction in places.	Slight to moderate: moderately rapid permeability; permeable cover soil.	Slight
OrD	Moderate: 5 to 11 percent slopes; contamination of ground water a possible hazard.[3]	Severe: 5 to 11 percent slopes; moderately rapid permeability.	Moderate: 5 to 11 percent slopes; danger of caving.	Moderate: 5 to 11 percent slopes; needs compaction in places.	Slight to moderate: moderately rapid permeability; permeable cover soil.	Moderate: 5 to 11 percent slopes.
Thurman:						
ThC	Slight: contamination of ground water a possible hazard.[3]	Severe: rapid permeability.	Severe: loamy sand texture; danger of caving.	Slight	Slight to moderate: rapid permeability; permeable soil cover; contamination of ground water a possible hazard.[3]	Slight
ThE	Moderate: 7 to 15 percent slopes; contamination of ground water a possible hazard.[3]	Severe: rapid permeability; 7 to 15 percent slopes.	Severe: loamy sand texture; 7 to 15 percent slopes; danger of caving.	Moderate: 7 to 15 percent slopes.	Slight to moderate: rapid permeability; permeable cover on soil; contamination of ground water a possible hazard.[3]	Moderate: 7 to 15 percent slopes.
TsC	Moderate to severe: moderate permeability below depth of 40 inches.	Moderate: moderate permeability below depth of 40 inches.	Moderate to severe: danger of caving.	Slight	Slight to moderate: rapid permeability; permeable cover soil; contamination of ground water a possible hazard.[3]	Slight to moderate: moderate shrink-swell potential below depth of 40 inches.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of— Road fill	Sand	Topsoil	Soil features affecting— Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	Terraces and diversion
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Fair to poor: less than 8 inches thick; slopes erodible.	Low seepage; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity; erodible.	Erodible; short irregular slopes.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Fair to poor: less than 8 inches thick; slopes erodible.	Low seepage; moderate permeability; 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Fair compaction characteristics and stability; 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Drainage not needed.	High available water capacity; erodible; 7 to 11 percent slopes (NoD2) and 11 to 17 percent slopes (NoE2).	Erodible; short irregular slopes.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Fair: slopes erodible.	Low seepage; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	High available water capacity; erodible.	Erodible; short irregular slopes.
Fair: moderate shrink-swell potential; plasticity index of subgrade material is more than 15 in places.	(2)	Good to depth of 10 inches.	Low seepage; moderate permeability.	Fair compaction characteristics and stability.	Drainage not needed.	Slopes too steep in places.	Erodible; short irregular slopes.
Good	Poor: nonplastic fines.	Good to depth of 13 inches.	High seepage; moderately rapid permeability.	Medium permeability if compacted; fair stability.	Drainage not needed.	Moderate available water capacity; rapid infiltration; erodible.	Erodible by water and soil blowing.
Good	Poor: nonplastic fines.	Good to depth of 13 inches; 5 to 11 percent slopes; erodible.	High seepage; moderately rapid permeability.	Medium permeability if compacted; fair stability.	Drainage not needed.	Moderate available water capacity; rapid infiltration; 5 to 11 percent slopes; erodible.	Erodible by water and soil blowing.
Good	Fair: fine sand below depth of 2 feet.	Poor: loamy fine sand texture.	High seepage; rapid permeability.	Fair stability	Drainage not needed.	Low available water capacity; rapid infiltration.	Erodible by water and soil blowing.
Good	Fair: fine sand below depth of 2 feet.	Poor: loamy fine sand texture.	High seepage; rapid permeability.	Fair stability	Drainage not needed.	Low available water capacity; rapid infiltration; 7 to 15 percent slopes.	Erodible by water and soil blowing.
Good	Poor to depth of 3 feet; unsuited below depth of 3 feet.	Poor: loamy fine sand texture.	Moderate permeability below depth of 40 inches.	Moderate shrink-swell potential below depth of 40 inches.	Rapid permeability to depth of 40 inches.	Moderate permeability and high available water capacity below depth of 40 inches.	Erodible by water and soil blowing.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Foundations	Sanitary land fill[1]	Local roads and streets
Valentine: VbE	Slight: contamination of ground water a possible hazard.[3]	Severe: rapid permeability.	Severe: subject to caving.	Slight	Moderate to severe: rapid permeability; contamination of ground water a possible hazard; cover soil erodible by water and soil blowing.	Slight: erodible by water and soil blowing.
Wet alluvial land: Wx.	Severe: moderately slow permeability; water table at depth of 0 to 3 feet.	Severe: water table at depth of 0 to 3 feet.	Severe: very poorly drained; water table at depth of 0 to 3 feet.	Severe: water table at depth of 0 to 3 feet.	Severe: water table at depth of 0 to 3 feet.	Severe: high shrink-swell potential; subject to frost heave; water table at depth of 0 to 3 feet.
Zook: Zo	Severe: slow permeability: water table at depth of 3 to 8 feet.	Moderate to severe: water table at depth of 3 to 8 feet.	Severe: water table at depth of 3 to 8 feet.	Severe: moderate to high shrink-swell potential; highly subject to frost heave.	Severe: high shrink-swell potential; water table at depth of 3 to 8 feet.	Severe: high shrink-swell potential; plasticity index of subgrade material is more than 15; highly subject to frost heave.

[1] Onsite studies of the underlying strata, depth to water table, and hazards of ground-water pollution need to be made for sanitary land fills more than 5 to 6 feet deep.
[2] No sand available within an economical depth.

The mechanical analysis was made by a combination of the sieve and hydrometer methods.

Tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a dry condition, the soil changes from a solid to a plastic state and then to a liquid state. The *plastic limit* is the moisture content, expressed as a percentage of the oven-dry weight, at which the soil passes from a solid to a plastic state. The *liquid limit* is the moisture content at which the soil passes from a plastic to a liquid state. The *plasticity index* is the numerical difference in percentage of moisture between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is considered to be plastic. Some silty and sandy soils are nonplastic, which means that they do not become plastic at any moisture content.

Engineering properties of the soils

Table 6 shows estimated engineering properties of the soils based on the test data in table 5 and on other information obtained in the county during the survey. The sections "Descriptions of the Soils" and "Formation and Classification of the Soils" give more detailed information about the soils and geology. The data, listed by layers that have properties significant to engineering, include the USDA textural classification and the AASHO and Unified engineering classifications.

Table 6 also gives, for each layer, the particle-size distribution as the percentage that will pass a No. 10 sieve, a No. 40 sieve, and a No. 200 sieve. Estimates of the percentages passing the sieves are based on the assumption that material up to and including 3 inches in diameter equals 100 percent. No soils in Wayne County have a significant percentage of coarse materials greater than 3 inches in diameter. In the AASHO and Unified systems, soil particles retained on the No. 200 sieve are classified as sand and gravel. Silt and clay particles pass through this sieve. Particles retained on the No. 4 sieve are classed as gravel in the Unified system. Particles retained on the No. 10 sieve are classed as gravel in the AASHO system.

Silt and clay particles affect such properties as permeability, available water capacity, and shrink-swell potential. *Permeability* is the rate at which water moves through an undisturbed saturated soil. It depends on the texture, gradation, structure, and density of the soil and is measured in inches of water per hour. Terms used to describe permeability and the equivalent rates are given in the Glossary. In table 6, the permeability is given for the major significant soil horizons. *Available water capacity*, expressed in inches of water per inch of soil depth, is the capacity of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in a soil at field capacity and the amount at wilting point. *Shrink-swell potential* is an indication of the volume change to be expected in a soil when the soil moisture is changed. It is rated low, moderate, or high. Generally, soils with a high clay content have a high shrink-swell potential and clean sands and gravels have a low shrink-swell potential. Several soils in Wayne County, such as those in the Fillmore, Moody, and Zook series, have moderate to high shrink-swell potential.

Another important engineering property is soil reaction. *Reaction* of a soil is the degree of acidity or alkalinity, expressed as pH value or reaction class. A soil that has a pH of 7.0 is neutral; one that has a lower value is acid; and one that has a value greater than 7.0 is alkaline. In Wayne County, soils that have pH values greater than 7.5 or less than 6.5 and that are to be used as a construction site or as construction material in places where they

properties of the soils—Continued

Suitability as source of—				Soil features affecting—			
Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	Terraces and diversion
Good	Fair: fine sand below depth of 0.5 foot.	Poor: loamy fine sand texture.	High seepage; rapid permeability.	Good stability	Drainage not needed.	Low available water capacity; rapid permeability; erodible by water and soil blowing.	Terraces and diversions not needed.
Poor: high shrink-swell potential; subject to frost heave; water table at depth of 0 to 3 feet.	(3)	Poor: water table at depth of 0 to 3 feet.	Low seepage; moderately slow permeability.	Fair compaction characteristics and stability; borrow areas likely to be wet.	Water table at depth of 0 to 3 feet; areas of surface ponding at times.	Moderately slow permeability; water table at depth of 0 to 3 feet; not suited.	Terraces and diversions not needed.
Poor: high shrink-swell potential: plasticity index of subgrade material is more than 15; highly subject to frost heave.	(3)	Poor workability when dry or wet; water table at depth of 3 to 8 feet.	Low seepage; slow permeability.	Poor compaction characteristics.	Slow permeability; slow to very slow runoff; water table at depth of 3 to 8 feet.	Slow permeability; very slow runoff.	Terraces and diversions not needed.

[3] Material under soil is rapidly permeable.

will become and remain moist or saturated need to be investigated for their corrosive potential to metal structures. The reaction class for most soils in the county is given in table 6 and for most horizons of the representative profiles is given in the section "Descriptions of the Soils."

Engineering interpretations of the soils

In table 7 the soils are summarized with respect to their usefulness for various engineering purposes. Limitations for use as septic tank absorption fields, sewage lagoons, shallow excavations, foundations, sanitary land fill, and local roads and streets are rated *slight*, *moderate*, or *severe;* and suitability as a source of road fill, sand, or gravel is rated *good*, *fair*, or *poor*. Most ratings are followed by a listing of the principal soil characteristics that explain the rating. Also given in the table are the soil features that affect pond reservoir areas, embankments, dikes and levees, drainage for crops and pasture, irrigation, and terraces and diversions. The table is a guide to planning and to further investigation of the soils. Onsite determinations of the type, quantity, and engineering properties of the soil should be made prior to the beginning of construction projects.

The principal factors affecting use of soils for *septic tank absorption fields* and *sewage lagoons* are soil permeability, depth to the water table, and susceptibility to flooding. The limitation of a soil for absorption fields is slight if the soil has a high infiltration rate and contamination of ground water is not likely, moderate if the soil has moderate permeability, and severe if the soil is impervious or the water table is high. Because sewage lagoons must retain liquids long enough for aerobic decomposition of fresh sewage to occur, the limitation of an impervious soil for lagoons is slight, that of a somewhat more permeable soil is moderate, and that of a rapidly permeable soil is severe. Some soils having a moderate limitation can be used if the sides and bottom of lagoons are sealed with bentonite or sodium carbonate or are lined with a commercial plastic or rubber liner. Sewage absorption fields and disposal lagoons should be located so as not to contaminate domestic or stock water supplies. If located where subject to flooding, the hazard of contaminating drinking-water supplies is severe. Steepness of slope also needs to be considered in design of sewage-treatment facilities.

The use of a soil for *shallow excavations* is limited by a high water table, shallow depth to bedrock, steep slopes, and the potential for caving and for flooding. Shallow excavations are needed when burying utility lines and when digging basements, open ditches and channels, graves in cemeteries, and small ponds or dugouts.

An important property that affects the suitability of a soil for *foundations* is the bearing, or load-carrying, capacity of the soil. Most soils have a high bearing capacity when dry, but many have a lower bearing capacity when moist or saturated. The amount of compaction depends on the texture and moisture content of the soil; for example, loessal (wind-deposited) soils and some alluvial soils are subject to excessive consolidation when loaded and then saturated. The use of a soil for foundations also is limited by the soil's potential for shrinking and swelling, by its susceptibility to frost action, and by depth to the water table. Loss and gain of moisture affect the shrinking and swelling of clay soils. Loss of moisture to landscape plantings close to a building can cause consolidation of a clay soil and result in cracked walls. Moisture also affects the amount of frost heave, and for this reason foundation footings should extend below the depth of frost penetration. A high water table can prevent installation of

utilities and limit the type of plants that can be used for landscaping. A varying depth to the water table can contribute to uneven slab-on-grade foundations. Capacity for drainage, steepness of slope, depth to bedrock, and potential flooding of the soil are other factors affecting foundations.

Sanitary land fill is a means of disposing of refuse on land without creating nuisances or hazards to public health or safety. In both the area method and the trench method of land fill, the refuse is confined to the smallest practical area, is reduced to the smallest practical volume, and is covered with a layer of earth at the conclusion of each day's operation or at more frequent intervals if necessary.[7] For the area method, which is adapted to flat or gently sloping land and to ravines, quarries, and other land depressions where there is no danger of contaminating surface or underground water, cover soil is normally transported from adjacent areas. For the trench method, which can be used only where the water table is below the bottom of the trench, the soil from the trench is used to cover the compacted refuse. In table 7, the rating of the limitations of a soil for sanitary land fill is based on the suitability of the soil for daily and permanent refuse cover and on the potential pollution of streams and ground water by water passing through the refuse. Texture, slope, drainage pattern, depth to the water table, and potential flooding are other characteristics that limit the use of the soil for land fill. Because refuse generally contains many disease organisms that are hazardous to man and animal, investigations of the site of proposed sanitary land fills should evaluate the potential for pollution.

Factors limiting the use of soils for the construction and improvement of *local roads and streets* are potential frost action, plasticity, potential shrinking and swelling, depth to the water table, and steepness of slope. Where streets are not paved, erodibility also is an important property. When roads and streets are planned, consideration should be given to potential consolidation of the soils, depth to bedrock, and potential flooding.

Suitability of a soil for use as *road fill* depends upon its compressibility, workability (including loading and hauling), compaction characteristics, potential shrinking and swelling, and potential frost action. Soils used for embankments should have good stability in order to maintain slopes and resist erosion by water.

Factors in rating soil as a source of *sand* are depth to and gradation of the sand. Some sands are too fine grained for use in road surfacing or in concrete aggregates. In Wayne County, sand can be found in "dry pits" on the upland or it can be obtained from below the water table by hydraulic mining. Operational sandpits are a good guide to locations of sand of suitable quality and quantity.

Soils are rated as a source of *topsoil* in accordance with their ability to support vegetation and, thus, to reduce erosion. Topsoil is used to cover road and dam embankments and is used on excavated slopes and on lawns and gardens. Topsoil should be salvaged and stockpiled before earth-moving operations begin. The suitability of a soil for use as topsoil depends on its depth, fertility, organic matter, erodibility, workability, and quantity.

Soil features affecting *pond reservoir areas* are potential seepage, depth to sand and bedrock, depth to the water table, and steepness of slope. In Wayne County, farm ponds are used for stock water, erosion control, and recreation; reservoirs are used as a water supply, as lakes for recreation, and as lagoons for waste disposal. Most farm ponds and reservoirs lose water through seepage. To reduce this loss, ponds in soils underlain by sand or in soils above the water table need to be lined. The slope of the soil affects the storage volume of a pond and the potential sediment inflow.

Compaction characteristics and stability are important properties of soils that are used for *embankments, dikes,* and *levees*. Soils used for roads, dams, building foundations, and other embankments must be subjected to compaction in order to decrease their compressibility and permeability. Sandy soils with less than 15 percent of silt and clay particles can be compacted with vibratory rollers. Soils containing more than 15 percent fines can be compacted with tamping rollers or by riding over them in heavy equipment. The optimum moisture content should be maintained to insure proper compaction. Dikes and levees are used to control surface water. Dikes are low fills that divert water or that hold water in small reservoirs constructed partly above ground level. Levees are higher fills that are designed to prevent flooding from streams and canals and to impound water in larger reservoirs. Such fills are subject to erosion by rainfall and snowmelt and to seepage and compression. Dispersion of a soil by water can result in accelerated erosion and endangering of hydraulic structures. The shear strength of a fill determines the safety against failure by sliding. Some fills are subject to cracking, which can be caused by differential or excessive consolidation of the foundation or by shrinkage of the soil upon drying.

Soil features affecting *drainage for crops and pasture* are permeability and depth to the water table. Natural drainage, which is defined as the removal of excess water by vertical seepage, is hampered by precipitation in excess of the seepage rate and, in places, by seasonal flooding. Artificial drainage methods, such as removing water by open ditches or through tiles, can be helpful but in places is complicated by the lack of outlets, by low soil permeability, or by the sloughing of ditchbanks.

Factors limiting the suitability of a soil for *irrigation* of cropland are excessive steepness of slope, irregular topography, limiting depths of cuts for leveling, susceptibility to soil blowing, slow water-intake rate, low available water capacity, and shallow depth to the water table. Possible flooding and salinity of the soil are other factors that should be considered. Some soil factors also limit the type of irrigation equipment that can be used for a particular crop. The suitability of grassed pasture for irrigation is less affected by features such as slope and soil blowing. Detailed information for irrigation planning, design, and methods can be found in the "Irrigation Guide for Nebraska".[8]

Features affecting the suitability of soils for *terraces and diversions* and for associated grassed waterways are erodibility by water, steepness of slope, topography,

[7] AMERICAN SOCIETY OF CIVIL ENGINEERS, COMMITTEE ON SANITARY LAND FILL PRACTICE: SANITARY LAND FILL. ASCE Manual of Engineering Practice No. 39.

[8] UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, LINCOLN, NEBR. IRRIGATION GUIDE FOR NEBRASKA. 1971.

fertility, and ability to maintain vegetal cover. Salinity and the depth to sand or bedrock also should be considered. Current farming practices affect the dimensions and layout of terraces.

Formation and Classification of the Soils

The first part of this section describes factors that have affected formation and development of soils in Wayne County. The second part explains the system of soil classification currently used and classifies each soil series of the county according to that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on parent material that accumulated through weathering of rock. The characteristics of soil at any given place are determined by the (1) physical and mineralogical composition of the parent material, (2) climate, (3) plant and animal life on and in the soil since the beginning of its formation, (4) relief, or lay of the land, and (5) length of time that forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Usually, long periods of time are needed for changing the parent material into a soil profile and for differentiating the soil into distinct horizons.

The factors of soil formation are closely interrelated in their effects on the soil. Few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

Parent material is the disintegrated and partly weathered rock in which soil forms. The soils of Wayne County developed in several kinds of parent material: loess, alluvium, eolian sand, and till.

Belfore, Moody, Nora, Loretto, and Crofton soils formed in Peoria loess, which is a brown or yellowish-brown material that was deposited by wind. This loess deposit is the most extensive parent material in the county and ranges from less than 1 foot to more than 100 feet in thickness. It is mostly silt but contains small amounts of clay and sand. Most soils that formed in Peoria loess have more strongly developed profiles than those formed in younger materials, because the soil-forming processes have been active over a longer period. No soil in the county developed in Loveland loess, which crops out on the sides of a few drainageways and along some banks where the streams have cut down to this formation. Loveland loess, also deposited by wind, is reddish brown and is older than Peoria loess.

Colo, Lamo, Kennebec, Judson, and Zook soils formed in alluvium, which is water-deposited sediment on former flood plains that are now stream terraces and on the present-day flood plains. Alluvium is the youngest parent material in the county.

Thurman and Valentine soils developed in eolian, or wind-deposited, sand. This sand probably had its origin in sandy alluvium or in the sandhills west of the county and occurs in the southwestern corner and along the western edge of the county.

In Wayne County, the only soils that formed in till are in the Hadar series. The parent material of these soils is a glacial deposit consisting of clay mixed with numerous pebbles and stones. Till is common in the southwestern part of the county. In other places, it crops out only in small areas.

Climate

Climate affects the formation of soils through its influence on the rate of weathering and reworking of parent material by rainfall, temperature, and wind. Soil formation progresses slowly when the soil is dry. For this reason, soils generally are less well developed in arid regions than in humid regions. The amount of moisture affects the amount of vegetation available to micro-organisms for conversion to humus. The amount of organic matter available for soil formation is dependent on the length of the growing season and on the prevailing temperature during that time, because these factors directly affect the activity of the micro-organisms that work the soil. Sediments deposited by the wind also are an important factor in soil formation.

Wayne County has a mid-continental climate characterized by wide seasonal variations. Temperatures above 100° F in summer and below 0° F in winter are common. Except for minor variations, the climate is reasonably uniform throughout the county. Differences in the soil from one place to another thus are seen to be the result not of the climate alone but of the interrelationship of the climate with other soil-forming factors.

Plant and animal life

Trees, grasses and forbs, micro-organisms, earthworms, small burrowing animals, and other plants and animals on and in the soil are all active in the soil-forming process. The native vegetation in Wayne County was principally tall grass. The most important grasses were and are big bluestem, switchgrass, and indiangrass. Each year the grasses produce vegetation that dies in the fall and forms organic matter, which changes to humus and gives the soils their dark color. The tall grasses form more vegetation than the shorter grasses in the western part of the State; hence, the soils in Wayne County are darker than those farther west. The decayed fibrous root systems of the grass help develop good structure and tilth in the surface layer. Good tilth makes the soil easier to work. Along streams and in depressions on the upland, woody plants and other kinds of wetland vegetation produce different kinds and amounts of organic matter.

When plants decay, micro-organisms act upon the organic matter and decompose it into stable humus. These micro-organisms include nematodes, protozoa, and bacteria. Some bacteria take and store nitrogen from the air. When these bacteria die, the nitrogen becomes available in the soils. Fungi and such small animals as millipedes, spiders, and mites also act upon organic

matter and decompose it into humus. Earthworms, moles, gophers, and insects affect the formation of soils by mixing and working the organic and mineral matter. The mixing and working accelerate soil development and help make the soil more friable.

Man also affects the formation of soils. He determines, by the kind of management he practices, whether the soil is conserved or is lost through erosion, whether the fertility is maintained, and what kinds of vegetation are dominant. Man affects the future direction and rate of soil formation through his control of runoff and his management practices on land under cultivation.

Relief and drainage

Relief, or lay of the land, affects the formation of soils through its effect on runoff and drainage. The degree of slope, shape of the surface, and permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soil.

The landscape of Wayne County consists mainly of nearly level tablelands, gently sloping to moderately steep slopes, and narrow ridgetops. Soils on north- and east-facing slopes have a thicker surface layer than soils on south- and west-facing slopes. The latter receive more direct sunlight, and this results in more rapid drying, less vegetative growth, and less organic-matter accumulation than occur on slopes protected from direct sunlight. Most of the erosion occurs during the growing season and is caused by storms that generally move easterly or northerly. After fall plowing, westerly winds remove soil particles from the west-facing slopes and deposit them on east-facing slopes.

Surface drainage depends mostly on the slope of the soil; the steeper the slope, the less moisture is absorbed. Where runoff is slow, water penetrates the soil, causes silt to weather to clay, and leaches certain elements into lower horizons. Moisture and internal drainage are important factors in forming the horizons of a soil. In Wayne County, most soils are well drained, and runoff ranges from slow to rapid. Soils such as the Belfore, which are on nearly level tablelands where runoff is slow, tend to have a finer textured subsoil and deeper leaching of lime than soils having steeper slopes. Crofton soils, on the steeper parts of the landscape, have lime near the surface; and Nora soils, on the gentler slopes, have lime at moderate depths. Because they are poorly drained, depressions on the tableland are deeply leached and have a claypan subsoil. Some soils on bottom lands, such as the Lamo, have a moderately high water table. Moisture from the zone of saturation is brought to the root zone by capillary action and is used by plants, which redistribute plant nutrients and thus aid in soil development.

Time

Time is needed for the active agents of soil development to form soils from parent material. Some soils form rapidly and others slowly. The length of time for a particular soil to form depends on the other factors involved. The oldest soils in Wayne County are those in the Moody and Belfore series, which have well-developed genetic horizons. Soil materials in which they formed have been in place long enough for climate, plant and animal life, and relief to alter the parent material. Examples of younger, immature soils, which have not had time to develop such definite horizons are the Judson soil, which formed in colluvial-alluvial sediments at the bases of steeper slopes; the Colo soils, which are on bottom lands where deposition continues to take place; and the Crofton soils, which have moderately steep slopes and lose soil material through erosion about as fast as it forms.

Classification of the Soils

Soils are classified so that we can more easily distinguish their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. Through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

In a classification system, soils are placed in broad categories to facilitate study and comparison in large areas, such as countries and continents. These broad categories are divided and subdivided into narrower classes that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing agricultural land and woodland, in developing rural areas, in engineering work, and in many other ways. The system of classifying soils that is currently used was adopted by the National Cooperative Soil Survey in 1965. This system is under continual study, and readers interested in the latest developments of the system should refer to the available literature (*2*, *5*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, suborder, great group, subgroup, family, and series. In this system, the criteria used as a basis for classification are soil properties that are observable or measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. The classes of the current system are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties that differentiate these orders are those that give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. In Wayne County, the only soil orders are Entisols and Mollisols.

Entisols are light-colored soils that do not have natural genetic horizons or that have only very weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

Mollisols formed under grass and have a thick, dark-colored surface horizon containing colloids dominated by bivalent cations. The soil material in these soils has not been mixed by shrinking and swelling.

SUBORDER.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. A suborder has a narrower climatic range than an order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or that reflect differences in climate or vegetation.

GREAT GROUP.—Suborders are divided into great groups on the basis of uniformity in the kinds and sequence

of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or the movement of water. Among features considered are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUP.—Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups also are made in instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

FAMILY.—Families are distinguished within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—Families are divided into smaller groups called series. A series consists of a group of soils that formed from a particular kind of parent material having genetic horizons which, except for the texture of the surface soils, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineralogical and chemical composition. A series generally is named after the geographical location at or near the place where the series was first observed and mapped.

The names of the orders, suborders, great groups, and subgroups are distinctive; each indicates the category of soil classification to which the named class belongs. Moreover, the names are designed so that the name of each subgroup places it in the great group, suborder, and order with which it is identified. For example, the name Cumulic Hapludoll indicates a subgroup, and from that name, one can identify the great group (Hapludoll), the suborder (Udoll), and the order (Mollisol). The names of the classes also are descriptive. They are rooted in the classical languages and connote properties of the specified class of soils. For example, the Kennebec series is classified as a Cumulic Hapludoll, which indicates that the soils developed from materials that "accumulated," are haplous or simple, without form or horizon, and are udic or occur in a humid climate. In fact, Kennebec soils are deep, dark soils that formed in wide bottom lands. They lack well-formed genetic horizons and occur throughout the humid parts of the State.

Table 8 shows the classification of each soil series of Wayne County by family, subgroup, and order according to the current system. The great group is not shown separately in this table because the last word in the subgroup is the great group. Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available. The classification used here is current as of June 1973.

Mechanical and Chemical Analyses

Information useful to soil scientists in classifying soils and in developing concepts of soil genesis can be obtained from laboratory analysis of the soils. This information also is helpful in estimating available water capacity, soil-blowing potential, fertility, and tilth, and in other practical aspects of soil management. The data on reaction, electrical conductivity, and percentage of exchangeable sodium are helpful in evaluating the possibility of reclaiming and managing saline-alkali soils.

Samples of Moody soils from Wayne County and of Belfore and Nora soils from nearby counties were collected for mechanical and chemical analysis by the Soil Conservation Service Soil Survey Laboratory in Lincoln, Nebraska. These data are recorded in Soil Survey Investigations Report Number 5 (*7*).

Natural and Cultural Features of the County

This section is mainly for those not familiar with the area. Information is given on the geology, relief, water supply, climate, and agricultural trends in Wayne County

TABLE 8.—*Soil series classified according to the current system of classification*

Soil series	Family	Subgroup	Order
Belfore	Fine, montmorillonitic, mesic	Udic Haplustolls	Mollisols.
Blendon	Coarse-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Colo	Fine-silty, mixed, mesic	Cumulic Haplaquolls	Mollisols.
Crofton	Fine-silty, mixed (calcareous), mesic	Typic Ustorthents	Entisols.
Fillmore	Fine, montmorillonitic, mesic	Typic Argialbolls	Mollisols.
Hadar	Sandy over loamy, mixed, mesic	Udic Haplustolls	Mollisols.
Judson	Fine-silty, mixed, mesic	Cumulic Hapludolls	Mollisols.
Kennebec	Fine-silty, mixed, mesic	Cumulic Hapludolls	Mollisols.
Lamo	Fine-silty, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.
Loretto	Fine-loamy, mixed, mesic	Udic Haplustolls	Mollisols.
McPaul	Coarse-silty, mixed (calcareous), mesic	Typic Udifluvents	Entisols.
Moody	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Nora	Fine-silty, mixed, mesic	Udic Haplustolls	Mollisols.
Ortello	Coarse-loamy, mixed, mesic	Udic Haplustolls	Mollisols.
Thurman	Sandy, mixed, mesic	Udorthentic Haplustolls	Mollisols.
Valentine	Mixed, mesic	Typic Ustipsamments	Entisols.
Zook	Fine, montmorillonitic, mesic	Cumulic Haplaquolls	Mollisols.

There follows a discussion of the early history and population, industry, transportation, and cultural and recreational features.

Geology, Relief, and Water Supply

Wayne County lies in the northern part of the rolling hills topographic region of Nebraska. The continental glaciers of Nebraskan and Kansan age advanced over the area and, on melting, left it covered with rock debris called glacial drift. For the most part, the glacial drift consists of till, which is a heterogeneous mass of clay, silt, gravel, and boulders. It also includes some moderately well sorted sand and gravel beds. The glacial drift had an irregular surface which, after some reshaping by erosion, became mantled by an eolian (wind-deposited) silty material called loess. The loess has a low sand content and has an average thickness of about 45 feet. In the southwestern part of the county is an area of eolian sand. In a few places, drainage entrenchment or accelerated erosion has removed the wind-deposited sediments and exposed the glacial drift.

Long slopes, rolling hills, and broad, low-gradient stream valleys are characteristic of the landscape. Broad, gently undulating uplands having narrow to broad ridgetops separate the intermittent upland drainageways. Relief from the crest of the ridgetops to the bottom of the adjacent drainageways ranges from 100 to 200 feet. Most bottom lands are less than a mile wide.

The elevation in Wayne County ranges from 1,360 feet near Logan Creek in the northeastern part of the county to 1,840 feet in the northwestern part. Although the difference between the lowest and highest elevation is 480 feet, the elevation in most of the county ranges between 1,450 and 1,750 feet.

Water in Wayne County is obtained mostly from wells that tap glacial sand and gravel beds. Sufficient water for domestic use and livestock is available from wells in most places. Most wells, including those for irrigation, are 125 to 225 feet deep on the uplands and 50 to 100 feet deep on bottom lands and stream terraces. In a few upland areas, wells for domestic and livestock water supplies are 200 to 300 feet deep. A few farmers obtain water for irrigation directly from creeks.

Climate [9]

The climate of Wayne County is distinctly continental. Summers are relatively warm, winters are cold, and rainfall is moderate. However, the temperature and rainfall vary greatly from day to day and from season to season. There are no nearby bodies of water large enough to have a major influence on the climate. Most of the rain that falls on the county is the result of moisture brought by southerly winds from the Gulf of Mexico. Rapid changes in temperature are caused by an interchange of warm air from the south and southwest with cold air from the north and northwest. Temperature and precipitation data are given in table 9.

Normally more than three-fourths of the annual precipitation falls during the months of April through September. This period covers the major part of the active growing season. Precipitation early in spring is slow, steady, and

[9] By RICHARD E. MYERS, State climatologist for Nebraska, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation*

[Temperature data for Wakefield; precipitation data for Winside. Averages based on period 1941–70. Probabilities based on period of record: Wakefield, 1895–1970; Winside, 1936–70]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Average number of days having snow cover of 1 inch or more	Average depth of snow on days having snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Equal to or less than—	Equal to or more than—		
	°F	°F	°F	°F	Inches	Inches	Inches		Inches
January	31	7	52	−13	0.7	0.1	1.4	16	4
February	36	13	56	−10	.9	.2	1.9	15	5
March	45	22	68	2	1.5	.4	2.4	9	6
April	63	36	81	22	2.3	.7	4.1	1	3
May	74	47	89	34	3.7	1.5	6.2	(1)	4
June	83	58	96	45	4.8	2.1	7.2	0	----------
July	88	62	100	52	3.3	1.1	6.1	0	----------
August	86	60	98	49	3.0	1.6	6.4	0	----------
September	77	50	94	36	2.5	.6	6.2	0	----------
October	67	39	85	25	1.6	.3	3.6	(1)	3
November	49	24	69	8	.9	1	2.3	3	3
December	35	13	55	−9	.7	.1	1.7	10	3
Year	61	36	[2] 102	[3] −22	25.9	20.3	34.7	54	4

[1] Less than half a day.
[2] Average annual highest temperature.
[3] Average annual lowest temperature.

well distributed. As the season advances, more and more of the rain falls during erratic thundershowers. By the latter part of May, nearly all of the precipitation comes in this manner. Thunderstorms in spring and early summer are severe at times, and some are accompanied by heavy local downpours, hail, and damaging winds. Heavy rains are likely to fall in one area, though little or no rain falls in a nearby area. At any place in the county, an inch of rain falls in half an hour on an average of once a year and more than 2 inches falls in 2 hours about once in 5 years. Rain falls in even greater intensity for brief periods. About once every 2 years a local downpour at a rate of 4 inches per hour lasts for 5 to 10 minutes. Hailstorms that accompany some of the downpours generally are local and last only a short time. Erosion occurs as a result of heavy rains, and damage from hail is variable and occurs in scattered areas. Occasionally a tornado occurs. Local drought conditions develop when showers become poorly spaced in time or area.

Fall weather generally is characterized by an abundance of sunshine, mild days, and cool nights. Most of the winter precipitation is in the form of snow, generally light but occasionally heavy. Low temperatures and strong northerly winds frequently accompany the snow, which then piles up in huge drifts. The average annual snowfall is about 32 inches, but the amount varies considerably from year to year. Snow covers the ground for 54 days in an average winter. Frequently the snow from one storm melts before the next snow falls.

The average annual highest summer temperature in Wayne County is 102° F, and the average annual lowest winter temperature is −22°. In 1936 the temperature reached 115°, and in 1912 it fell to −41°. One July out of five can be expected to have at least 4 days when the temperature reaches 100° or more, and one January in five can be expected to have at least 4 nights when the temperature falls to −13° or lower.

The growing season, defined as the number of days between the last freezing temperature in the spring and the first in the fall, averages about 147 days. Table 10 gives the probabilities of specified temperatures in spring and fall. This table shows that the average date of the last 32° temperature in spring is May 7, and the average date of the first frost in fall is October 2. A hard freeze of 16° can be expected before October 21 in 1 year in 10.

Annual evaporation from shallow lakes in the county averages about 40 inches. Approximately 77 percent of the total evaporation occurs between May 1 and October 31.

Agricultural Trends

Farming has been the most important means of livelihood in Wayne County since the area was first settled. Today, feeding beef cattle in drylots, raising hogs, and producing crops for feed and silage are the principal farming enterprises, although cash-grain and general farming also are important.

Feeding beef cattle has become an increasingly important business in the county. According to the USDA Census of Agriculture for 1969, the number of cattle being fed increased from 31,044 in 1954 to 68,998 in 1964, and to 75,029 in 1969. The number of hogs and pigs raised in the county has decreased from 127,684 in 1959 to 110,770 in 1969, and the number of milk cows decreased from 7,882 in 1954 to 4,327 in 1969. In 1964, livestock farms numbered 760. Only a few draft horses are in the county, but there are quite a few riding horses and several riding clubs.

Corn is by far the most important crop in the county. The trend in total acreage is downward, but there has been a big increase in the yield per acre. In 1959, 5,727,178 bushels of corn were harvested from 112,828 acres and, in 1969, 5,017,642 bushels were harvested from 83,389 acres. During this period, the amount of land used for growing corn for silage increased from 2,669 acres to 7,420 acres.

Alfalfa is of major importance in the cropping sequence and is also important as hay for feeding cattle. In 1969, 80,900 tons of hay were harvested from 27,716 acres, in addition to the alfalfa left in the field for grazing. Soybeans have shown a large increase as an important cash-grain crop. In 1954, 45,329 bushels were harvested from 2,110 acres and, in 1969, 473,669 bushels were harvested from 17,708 acres. The production of grain sorghum has increased considerably but varies with the farm management program and the weather. In 1969, 297,613 bushels of grain were produced from 4,156 acres, and about 1,964 acres were harvested for silage. Oats, now much less im-

Table 10.—*Probabilities of specified temperatures in spring and fall* [1]

[All data for Wakefield]

Probability	Date for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 12	April 19	May 1	May 13	May 23
2 years in 10 later than	April 6	April 14	April 25	May 7	May 17
5 years in 10 later than	March 27	April 4	April 15	April 27	May 7
Fall:					
1 year in 10 earlier than	October 21	October 17	October 7	September 24	September 17
2 years in 10 earlier than	October 26	Ocrober 22	October 11	September 29	September 22
5 years in 10 earlier than	November 6	November 1	October 22	October 9	October 2

[1] All freeze data are based on temperatures in a standard National Weather Service thermometer shelter at a height of approximately 5 feet above ground and in a representative exposure. Lower temperatures will exist at times nearer the ground and in local areas subject to extreme air drainage.

portant than in past years, are planted as a nurse crop where alfalfa is seeded. Red clover, popcorn, winter wheat, rye, and barley are minor crops in the county. Small acreages of cucumbers have been grown under contract for use as pickles.

According to the USDA Census of Agriculture of 1969, the number of farms in Wayne County decreased from 1,265 in 1959 to 1,095 in 1964 and to 908 in 1969. During this period, the average size of farms increased from 217.5 acres to 291.8 acres. In 1969, about 32 percent of the farms were operated by tenants, 34 percent by owners, and 34 percent by part owners.

Early History and Population

The first settlers arrived in what is now Wayne County in 1868, and the area became a county in 1870. The pioneer moved west primarily to obtain his own land. Under the Pre-emption Act of 1841, he could buy land for a dollar and a quarter an acre after he had cultivated it for one year; under the Homestead Act of 1862, land became his after he had worked it for 5 years; and, later, under the Timber Culture Act of 1873, he could claim 160 acres after planting trees on one-fourth of it. The early settler underwent many hardships such as shortages of food, fuel, building materials, and transportation. Winters were severe, disease took its toll, and grasshoppers frequently ruined the crops. The first railroad in the county was completed in 1882, when a line was extended from Emerson, at the southeast corner of Dixon County, to Wayne. Telephone service was begun in 1897, and electricity became available in 1898.

According to census figures, the population of Wayne County had reached 10,397 by 1910, decreased to 10,129 by 1950, and increased to 10,400 by 1970. The population of Wayne, the county seat, increased from 1,130 in 1889 to 5,379 in 1970.

Industry, Transportation, and Cultural Facilities

The town of Wayne, in the northeastern part of the county, is the largest market and shopping center in the area. Hoskins and Carroll are towns in the western part of the county, and Winside is in the central part. Wakefield, which is just across the northeastern county line, also serves the area. Most of the industries in the county are related to agriculture. Each town has a grain elevator. These elevators handle most of the locally grown grain that is marketed. There is an alfalfa-dehydrating mill near Winside, a livestock sales yard in Wayne, and an egg processing plant at Wakefield. Several feed mills and fertilizer distribution plants are located in the county, and several firms sell and service farm machinery. The Wayne County Rural Electric Administration is located in Wayne, which has a municipal electric plant. Electricity is available throughout the county, and natural gas is available in the towns of Wayne, Winside, and Wakefield.

No Federal highways are in Wayne County, but State Highways 15, 16, 35, 57, and 98 traverse the area and serve as the main roads to markets. Several gravelled roads also provide access to markets. Graded roads are on most section lines, but these are not all-weather roads. Wayne has an airport with asphalt runways.

In Wayne County, some rural school districts have been consolidated, but most have not. Wayne, Winside, and Wakefield have high schools. Wayne State College, which has an enrollment that varies between 2,500 and 3,200 students, is located in Wayne. Wayne and Wakefield have hospitals. There are churches of various faiths in Wayne and throughout the county. A radio station in Wayne serves the county and adjoining areas. A biweekly newspaper is published in Wayne. Rural mail routes serve all residents of the county.

Outdoor recreation is provided by a few small man-made lakes, hunting on private lands, an 18-hole golf course at Wayne, a 9-hole course at Wakefield, and parks and picnic facilities at towns in the county.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is generally expressed as inches of water per inch of soil. In this survey, the classes of available water capacity for a 60-inch profile, or to a limiting layer, are as follows:

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 or more

Blowout. An excavation produced by wind action in loose soil, usually sand.

Buried soil. A developed soil, once exposed but now overlain by another soil more recently formed.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Cation. A positively charged ion.

Center pivot irrigation. An irrigation system whereby water is distributed by spraying from an arm that rotates about a point, generally a producing well, at the center of a circular field.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colloid. Any substance in a certain state of fine division, the colloidal state, in which the particles range in diameter from about 0.2 to about 0.005 micron. Mixed with certain media, colloids form so-called colloidal solutions. Opposed to crystalloid.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concave slope. A slope that is rounded inward, as the inside of a bowl.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to the terrace grade.

Convex slope. A slope that is rounded outward, as the outside of a bowl.

Deciduous. Refers to plants that lose their leaves at maturity, or at certain seasons. Contrasts with evergreen.

Depth, soil. Total thickness of weathered soil material over mixed sand and gravel or bedrock. In this publication the classes of soil depth are as follows:

	Inches
Very shallow	0 to 10
Shallow	10 to 20
Moderately deep	20 to 40
Deep	40 or more

Dispersion, soil. Deflocculation of the soil and its suspension in water.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Evergreen (botany). A plant or tree that remains verdant, such as conifer trees and many tropical plants. Evergreen is often used loosely as a synonym for conifer, but some conifers, such as the larch, are deciduous, and many evergreens, such as the laurel, are not conifers. Contrasts with deciduous.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water or nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity*, or *capillary capacity*.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artifically.

Forage. Plant material that can be used as feed by animals; it may be grazed or cut for hay.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ranges.

Friability. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Green manure. A crop grown to be turned under at an early stage of maturity, or soon after maturity, for purpose of improving the soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

A horizon.—The mineral horizon at the surface. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinc-

tive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by height of the water table, either permanent or perched. Relative terms for expressing lateral drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Landscape. All the characteristics that distinguish a certain kind of area on the earth's surface and give it a distinguishing pattern, in contrast to other kinds of areas. Any one kind of soil is said to have a characteristic natural landscape, and under different uses it has one or more characteristic cultural landscapes.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Legume. A member of the legume, or pulse, family (Leguminosae). One of the most important and widely distributed plant families. Includes many valuable forage species, such as peas, beans, peanuts, alfalfa, sweet clover, lespedeza vetch, and kudzu. Practically all legumes are nitrogen-fixing plants, and many of the herbaceous species are used as cover and green-manure crops. Even some of the legumes that have no forage value (crotalaria and some lupines) are used for soil improvement. Other legumes are locust, honeylocust, redbud, mimosa, wisteria, and many tropical plants.

Light soil. A term used for sandy, or coarse-textured, soil.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loam. A soil consisting of a friable mixture of varying proportions of clay, sand, and organic matter.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mature soil. Any soil with well-developed soil horizons having characteristics produced by the natural processes of soil formation and in near equilibrium with its present environment.

Mottling, soil. Irregular marking with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Mulch. A natural or artificially applied layer of plant residue or other material on the surface of the soil. Mulches are generally used to help conserve moisture, control temperature, prevent surface compaction or crusting, reduce runoff and erosion, improve soil structure, or control weeds. Common mulching materials are wood chips, plant residue, sawdust, and compost.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability, soil. The quality of a saturated soil that enables water or air to move through it. In this publication, permeability applies to that part of the soil below the Ap or equivalent layer, and above a depth of 60 inches, or to bedrock that occurs at a shallower depth. Where there is a change of two or more permeability classes within a short vertical distance, the classes and depths are stated. Classes of soil permeability in inches of water per hour are as follows:

	Inches per hour
Very slow	0.06 or less
Slow	0.06 to 0.2
Moderately slow	0.2 to 0.6
Moderate	0.6 to 2.0
Moderately rapid	2.0 to 6.0
Rapid	6.0 to 20.0
Very rapid	20.0 or more

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects soil management but not soil behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plastic (soil consistence). Capable of being deformed without being broken.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all of its horizons and extending into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land on which there are some forest trees.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are: *excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water. In this survey, the term "runoff" is used to mean "surface runoff."

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sandy soils. A broad term for soils of the sand and loamy sand classes; soil material with more than 70 percent sand and less than 15 percent clay.

Shrink-swell potential (engineering). Amount that a soil will expand when wet or contract when dry. Indicates kinds of clay in soil.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slope. Deviation of a surface from the horizontal, expressed as a percentage. In this survey these slope classes are recognized:

	Percent
Nearly level	0 to 1
Very gently sloping	1 to 3
Gently sloping	2 to 7
Moderately sloping or rolling	5 to 11
Moderately steep	11 to 20

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subgrade (engineering). The substratum, consisting of inplace material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. In this soil survey, the A2 horizon of a soil; generally, the layer immediately below the surface layer.

Surface layer. In this survey, the Ap and A1 horizons of the soil; generally, the layer at the surface, regardless of its thickness.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Underlying material. In this survey, the C horizon of a soil; generally weathered soil material immediately beneath the solum.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

V-ditches. Drainage ditches that are V-shaped and have smooth side slopes.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

Windbreak. Any shelter that protects from the wind. A vegetative windbreak is a strip of closely spaced trees or shrubs that is planted primarily to deflect wind currents and thereby reduce soil blowing, control snow drifting, conserve moisture, and protect crops, livestock, and buildings.

U. S. GOVERNMENT PRINTING OFFICE : 1975 O - 530-303

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Information about the use and management of each soil is given in the description of the capability unit, range site, or windbreak suitability group to which it is assigned. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 31.
Suitable trees for windbreaks, table 3, page 35.
Potential of soil associations for wildlife habitat, table 4, page 37.
Engineering uses of the soils, tables 5, 6, and 7, pages 38 through 51.

Map symbol	Mapping unit	Page	Capability unit: Symbol	Capability unit: Page	Range site: Name	Range site: Page	Windbreak suitability group: Name	Windbreak suitability group: Page
BeA	Belfore silty clay loam, 0 to 1 percent slopes	7	I-1	23	Clayey	33	Silty to Clayey	35
BmB	Belfore-Moody silty clay loams, 1 to 3 percent slopes	8	IIe-1	23	---------------	--	Silty to Clayey	35
	Belfore soil	--	------	--	Clayey	33	---------------	--
	Moody soil	--	------	--	Silty	33	---------------	--
BnC	Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes	8	IIIe-3	25	Sandy	33	Sandy	35
Ca	Colo silt loam, occasionally flooded	9	IIw-4	24	Subirrigated	32	Moderately Wet	36
Cb	Colo silty clay loam, drained	9	I-1	23	Silty Lowland	32	Silty to Clayey	35
Cc	Colo and Lamo silty clay loams	9	IIw-4	24	Subirrigated	32	Moderately Wet	36
CfC2	Crofton silt loam, 2 to 7 percent slopes, eroded	10	IIIe-9	26	Limy Upland	33	Silty to Clayey	35
CfD2	Crofton silt loam, 7 to 11 percent slopes, eroded	10	IVe-9	29	Limy Upland	33	Silty to Clayey	35
CfE2	Crofton silt loam, 11 to 20 percent slopes, eroded	10	VIe-9	30	Limy Upland	33	Silty to Clayey	35
Fm	Fillmore complex	11	IIIw-2	27	Clayey Overflow	32	Moderately Wet	36
HtE	Hadar-Thurman complex, 5 to 15 percent slopes	11	IVe-5	28	Sands	33	Sandy	35
JuC	Judson silt loam, 2 to 7 percent slopes	12	IIe-1	23	Silty	33	Silty to Clayey	35
Ke	Kennebec silt loam	12	I-1	23	Silty Lowland	32	Silty to Clayey	35
La	Lamo silt loam, occasionally flooded	13	IIw-4	24	Subirrigated	32	Moderately Wet	36
Lb	Lamo silty clay loam	13	IIw-4	24	Subirrigated	32	Moderately Wet	36
LvA	Loretto fine sandy loam, 0 to 2 percent slopes	14	IIe-3	24	Sandy	33	Sandy	35
Mc	McPaul silt loam	15	IIw-3	24	Silty Overflow	32	Moderately Wet	36
Md	McPaul silt loam, wet	15	IIw-4	24	Subirrigated	32	Moderately Wet	36
MhC	Moody silt loam, 2 to 7 percent slopes	16	IIe-1	23	Silty	33	Silty to Clayey	35
MoC	Moody silty clay loam, 2 to 7 percent slopes	16	IIe-1	23	Silty	33	Silty to Clayey	35
MoD	Moody silty clay loam, 7 to 11 percent slopes	16	IIIe-1	25	Silty	33	Silty to Clayey	35
MoD2	Moody silty clay loam, 7 to 11 percent slopes, eroded	16	IIIe-8	26	Silty	33	Silty to Clayey	35
MrC	Moody and Nora soils, 0 to 5 percent slopes	16	IIe-3	24	Silty	33	Sandy	35
MrD	Moody and Nora soils, 5 to 11 percent slopes	17	IIIe-3	25	Silty	33	Sandy	35
NoC2	Nora silt loam, 2 to 7 percent slopes, eroded	18	IIIe-8	26	Limy Upland	33	Silty to Clayey	35
NoD2	Nora silt loam, 7 to 11 percent slopes, eroded	18	IIIe-8	26	Limy Upland	33	Silty to Clayey	35
NoE2	Nora silt loam, 11 to 17 percent slopes, eroded	18	IVe-8	29	Limy Upland	33	Silty to Clayey	35
NrD	Nora-Moody silty clay loams, 7 to 11 percent slopes	18	IIIe-1	25	Silty	33	Silty to Clayey	35
NrE	Nora-Moody silty clay loams, 11 to 17 percent slopes	19	IVe-1	27	Silty	33	Silty to Clayey	35
OrC	Ortello fine sandy loam, 1 to 5 percent slopes	19	IIIe-3	25	Sandy	33	Sandy	35
OrD	Ortello fine sandy loam, 5 to 11 percent slopes	19	IVe-3	28	Sandy	33	Sandy	35
ThC	Thurman loamy fine sand, 2 to 7 percent slopes	20	IVe-5	28	Sandy	33	Sandy	35
ThE	Thurman loamy fine sand, 7 to 15 percent slopes	20	VIe-5	30	Sands	33	Very Sandy	36
TsC	Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes	20	IIIe-5	26	Sandy	33	Sandy	35
VbE	Valentine loamy fine sand, rolling	21	VIe-5	30	Sands	33	Very Sandy	36
Wx	Wet alluvial land	21	Vw-7	29	Wet Land	32	Undesirable	36
Zo	Zook silty clay loam	21	IIw-4	24	Clayey Overflow	32	Moderately Wet	36

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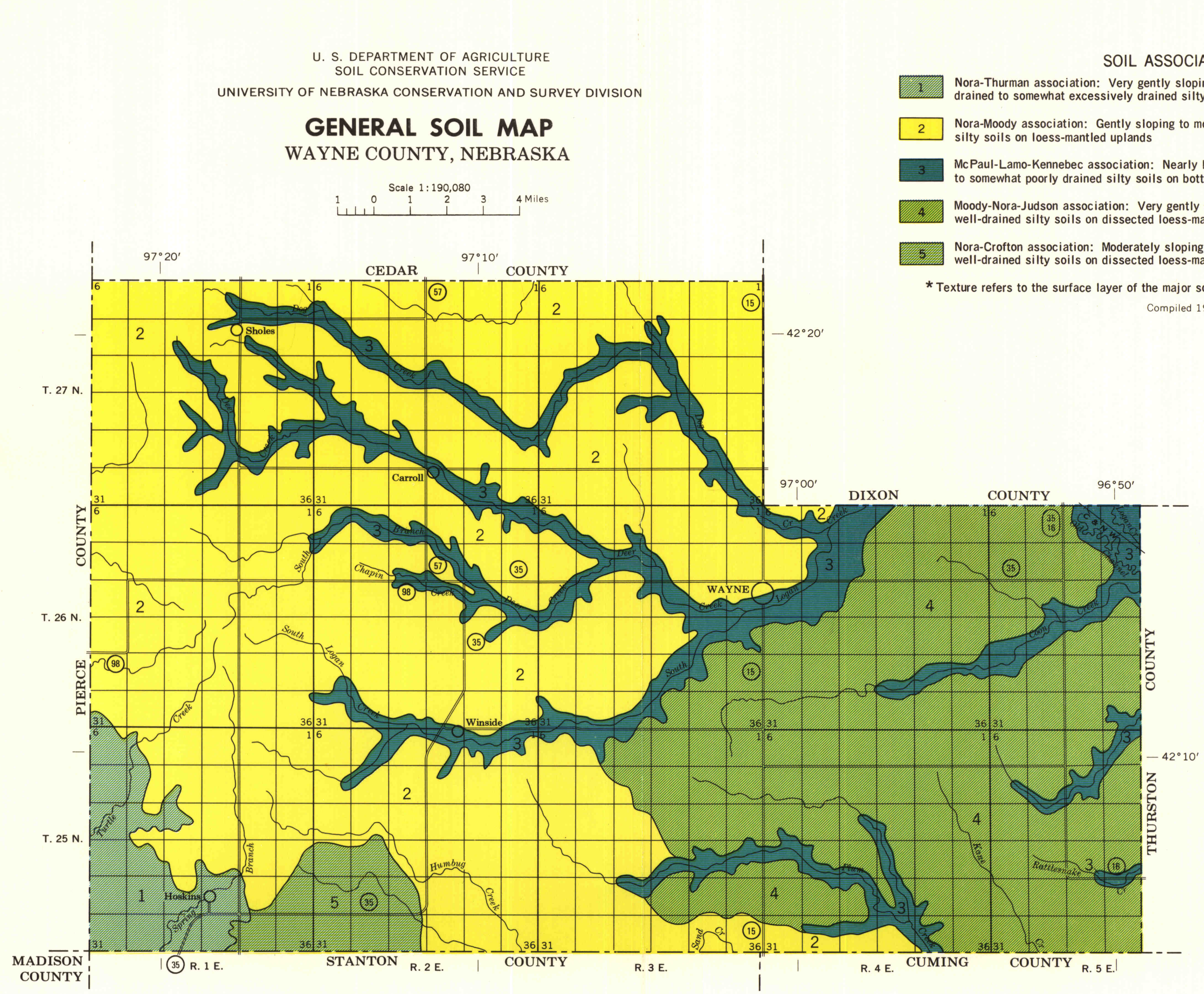
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP
WAYNE COUNTY, NEBRASKA

Scale 1:190,080



SOIL ASSOCIATIONS*

1 — Nora-Thurman association: Very gently sloping to moderately steep, deep, well drained to somewhat excessively drained silty, loamy, and sandy soils on uplands

2 — Nora-Moody association: Gently sloping to moderately steep, deep, well-drained silty soils on loess-mantled uplands

3 — McPaul-Lamo-Kennebec association: Nearly level, deep, moderately well drained to somewhat poorly drained silty soils on bottom lands

4 — Moody-Nora-Judson association: Very gently sloping to moderately sloping, deep, well-drained silty soils on dissected loess-mantled uplands

5 — Nora-Crofton association: Moderately sloping to moderately steep, eroded, deep, well-drained silty soils on dissected loess-mantled uplands

*Texture refers to the surface layer of the major soils.

Compiled 1973

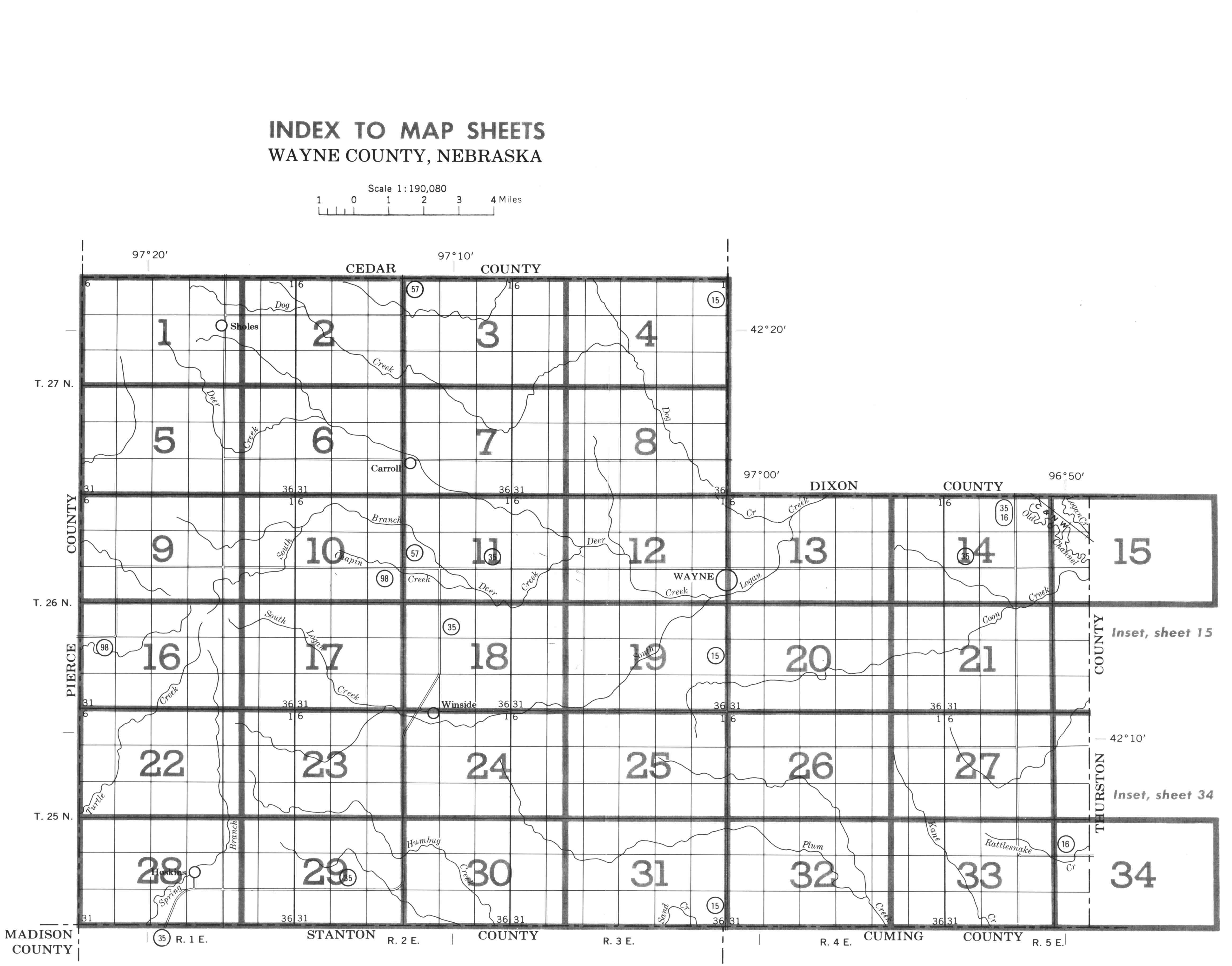
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
WAYNE COUNTY, NEBRASKA

Scale 1:190,080



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Glacial till
- Saline spot

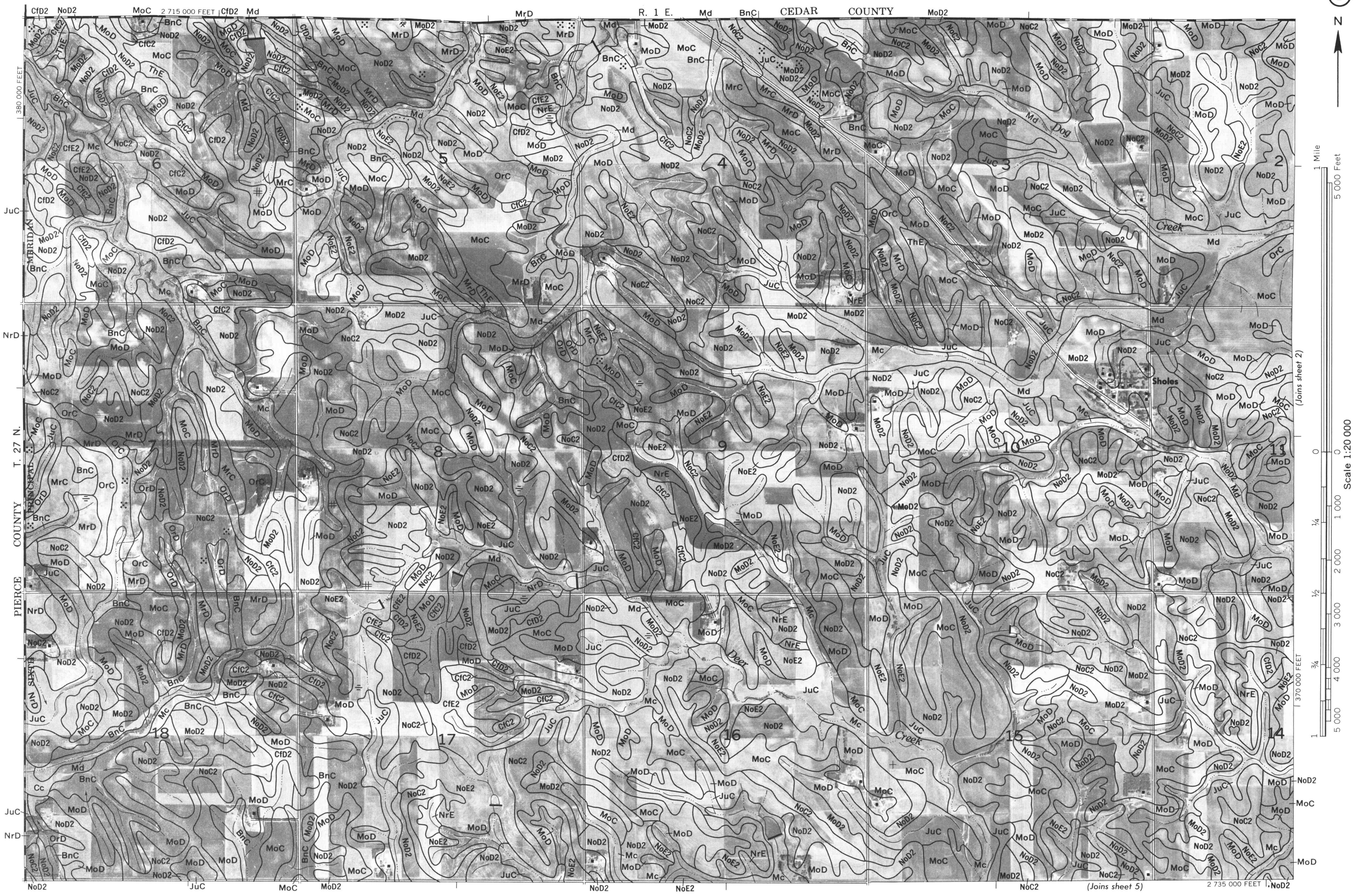
SOIL LEGEND

Each soil symbol consists of letters, or of letters and numbers; for example, Ca, HtE, or MoD2. If slope is given in the soil name, the third letter, A, B, C, D, or E, in a symbol shows the slope class. Symbols without a slope letter are those of nearly level soils or land types. A final number 2 in the symbol shows that the soil is eroded.

SYMBOL	NAME
BeA	Belfore silty clay loam, 0 to 1 percent slopes
BmB	Belfore-Moody silty clay loams, 1 to 3 percent slopes
BnC	Blendon fine sandy loam, clayey substratum, 1 to 5 percent slopes
Ca	Colo silt loam, occasionally flooded
Cb	Colo silty clay loam, drained
Cc	Colo and Lamo silty clay loams
CfC2	Crofton silt loam, 2 to 7 percent slopes, eroded
CfD2	Crofton silt loam, 7 to 11 percent slopes, eroded
CfE2	Crofton silt loam, 11 to 20 percent slopes, eroded
Fm	Fillmore complex
HtE	Hadar-Thurman complex, 5 to 15 percent slopes
JuC	Judson silt loam, 2 to 7 percent slopes
Ke	Kennebec silt loam
La	Lamo silt loam, occasionally flooded
Lb	Lamo silty clay loam
LvA	Loretto fine sandy loam, 0 to 2 percent slopes
Mc	McPaul silt loam
Md	McPaul silt loam, wet
MhC	Moody silt loam, 2 to 7 percent slopes
MoC	Moody silty clay loam, 2 to 7 percent slopes
MoD	Moody silty clay loam, 7 to 11 percent slopes
MoD2	Moody silty clay loam, 7 to 11 percent slopes, eroded
MrC	Moody and Nora soils, 0 to 5 percent slopes
MrD	Moody and Nora soils, 5 to 11 percent slopes
NoC2	Nora silt loam, 2 to 7 percent slopes, eroded
NoD2	Nora silt loam, 7 to 11 percent slopes, eroded
NoE2	Nora silt loam, 11 to 17 percent slopes, eroded
NrD	Nora-Moody silty clay loams, 7 to 11 percent slopes
NrE	Nora-Moody silty clay loams, 11 to 17 percent slopes
OrC	Ortello fine sandy loam, 1 to 5 percent slopes
OrD	Ortello fine sandy loam, 5 to 11 percent slopes
ThC	Thurman loamy fine sand, 2 to 7 percent slopes
ThE	Thurman loamy fine sand, 7 to 15 percent slopes
TsC	Thurman loamy fine sand, loamy subsoil, 2 to 7 percent slopes
VbE	Valentine loamy fine sand, rolling
Wx	Wet alluvial land
Zo	Zook silty clay loam

1

N



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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 1

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 2

WAYNE COUNTY, NEBRASKA NO. 2

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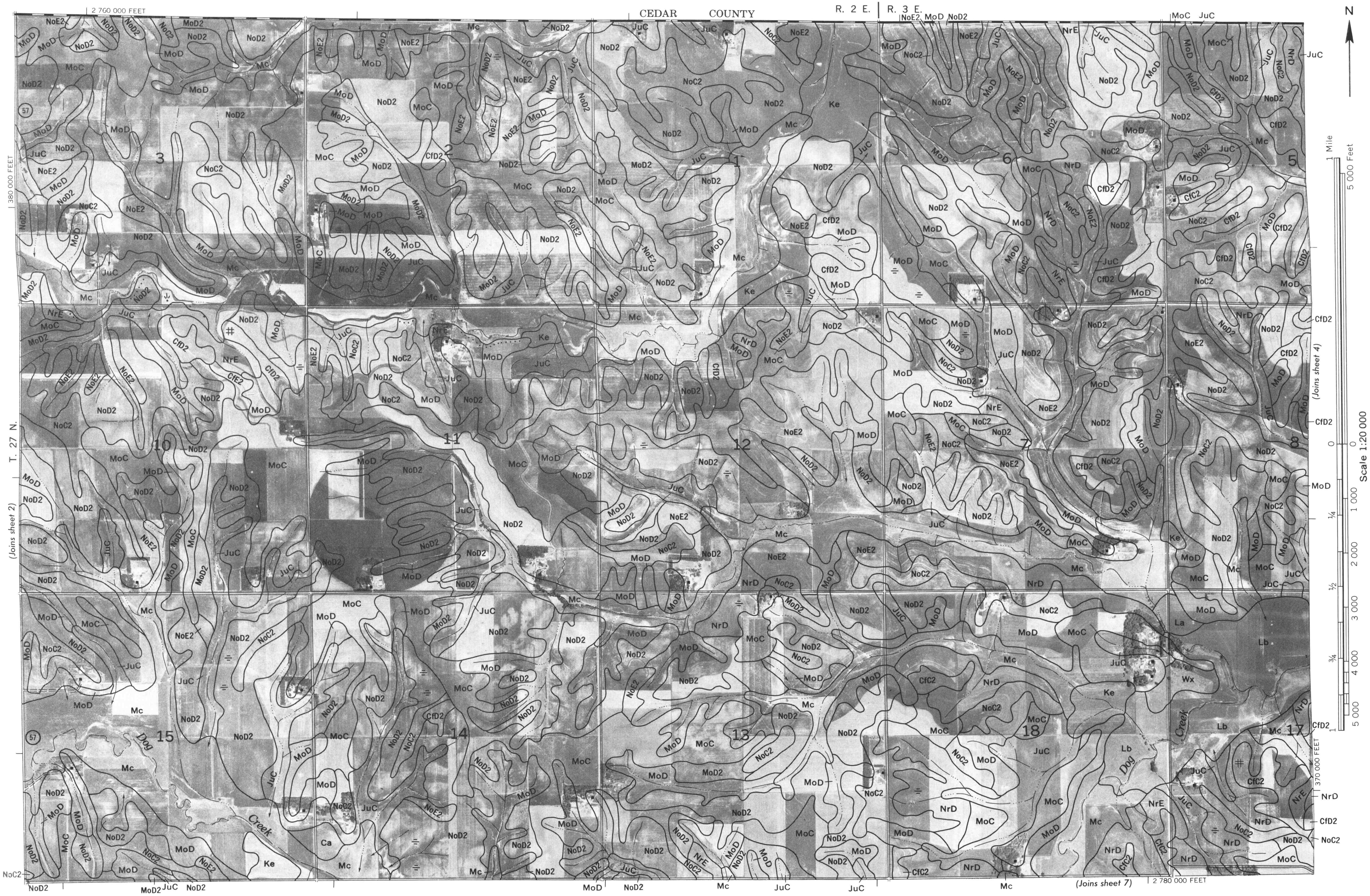

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WAYNE COUNTY, NEBRASKA — SHEET NUMBER 4

WAYNE COUNTY, NEBRASKA NO. 4

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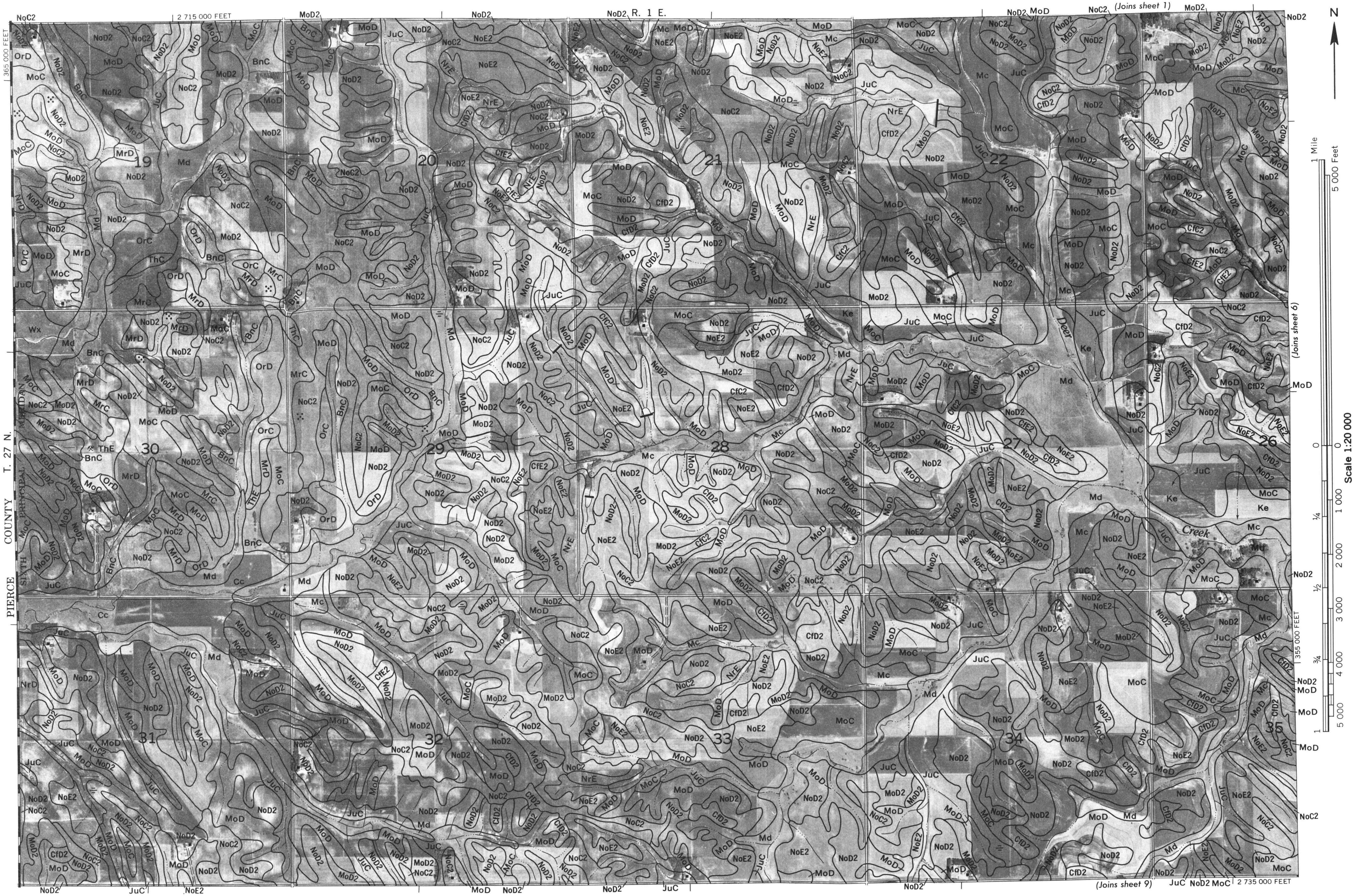
WAYNE COUNTY, NEBRASKA — SHEET NUMBER 5

5



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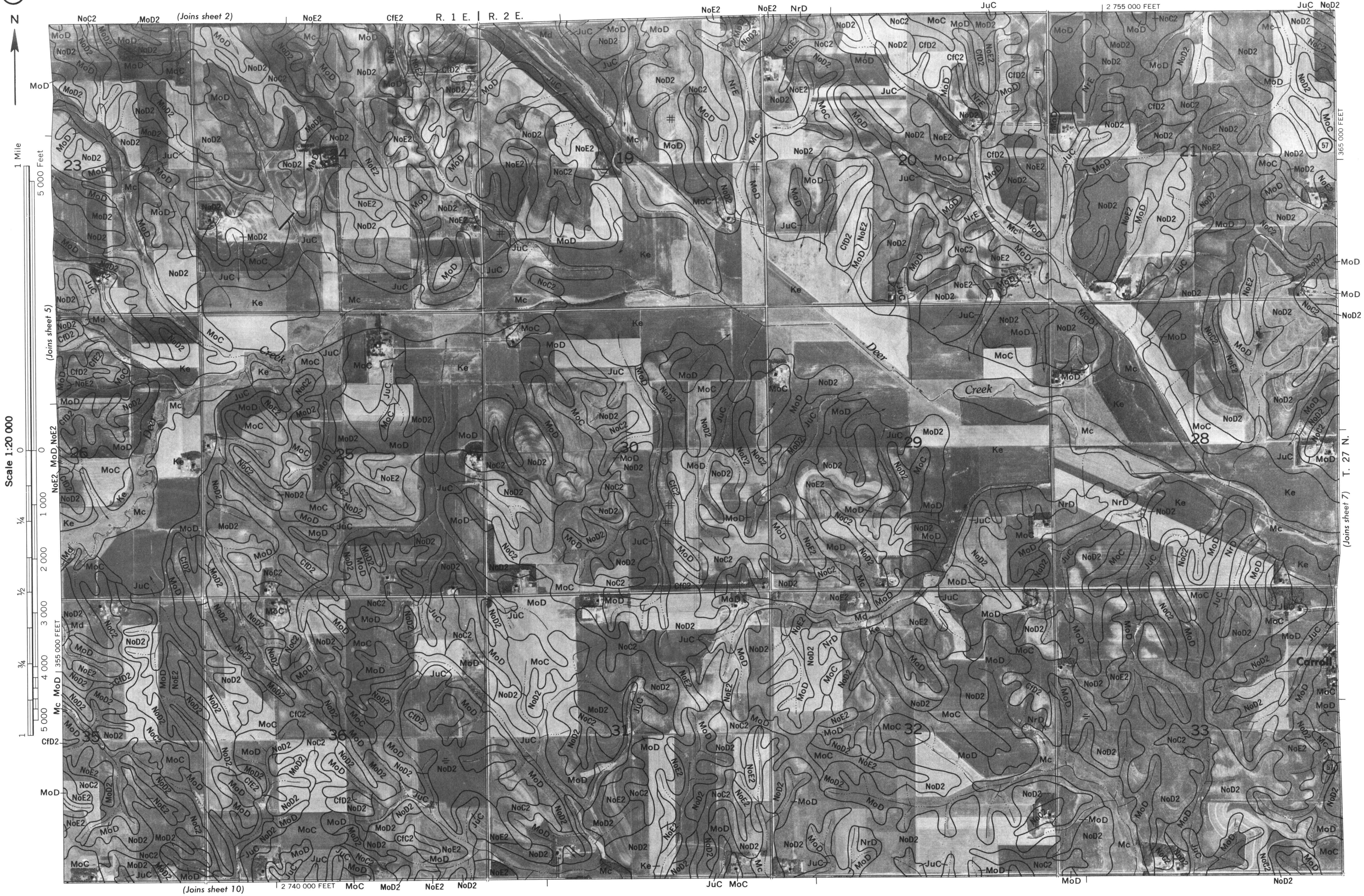
WAYNE COUNTY, NEBRASKA NO. 5

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 6



WAYNE COUNTY, NEBRASKA NO. 6

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WAYNE COUNTY, NEBRASKA — SHEET NUMBER 7

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WAYNE COUNTY, NEBRASKA NO. 7

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 8

WAYNE COUNTY, NEBRASKA NO. 8

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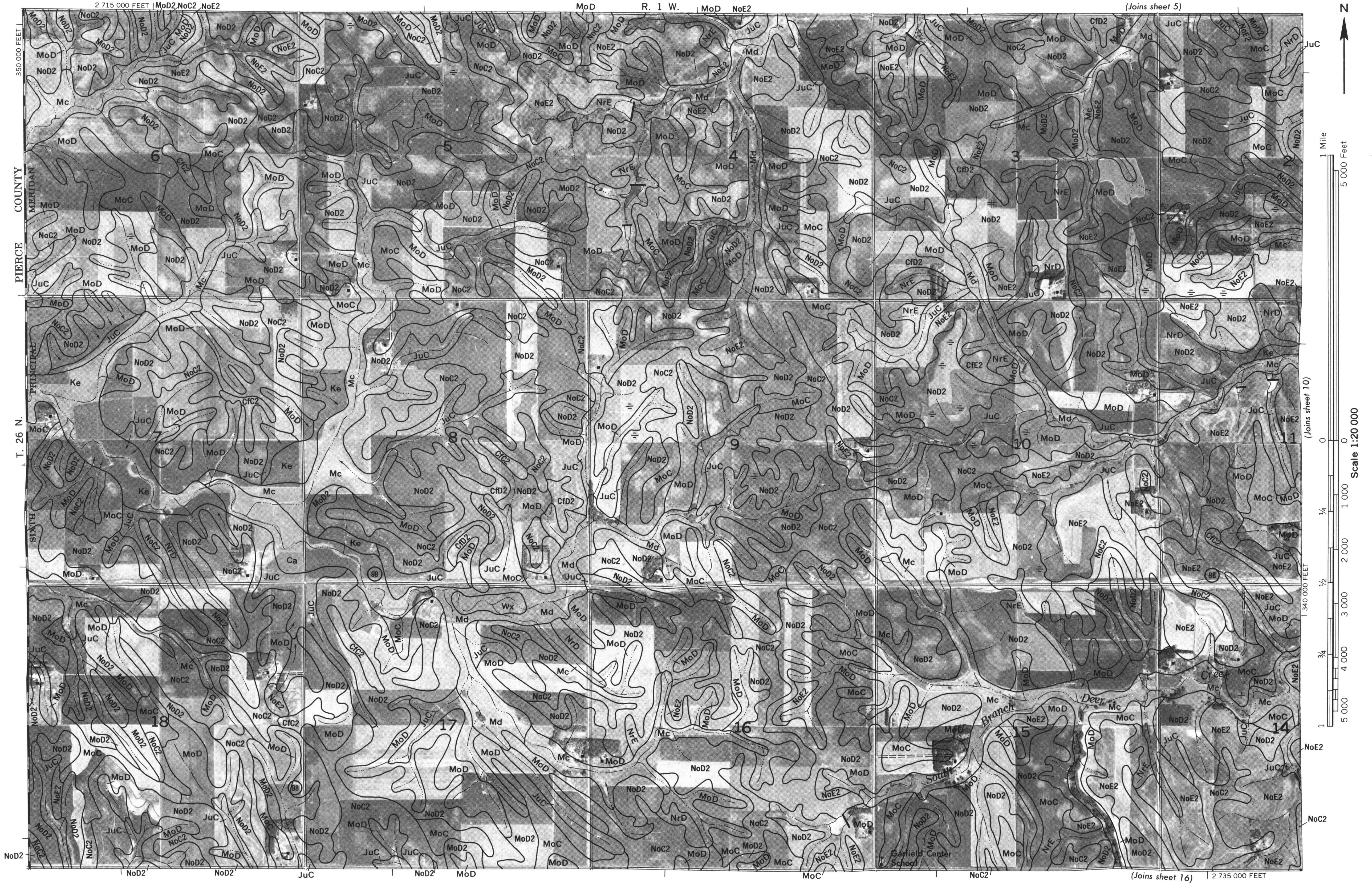

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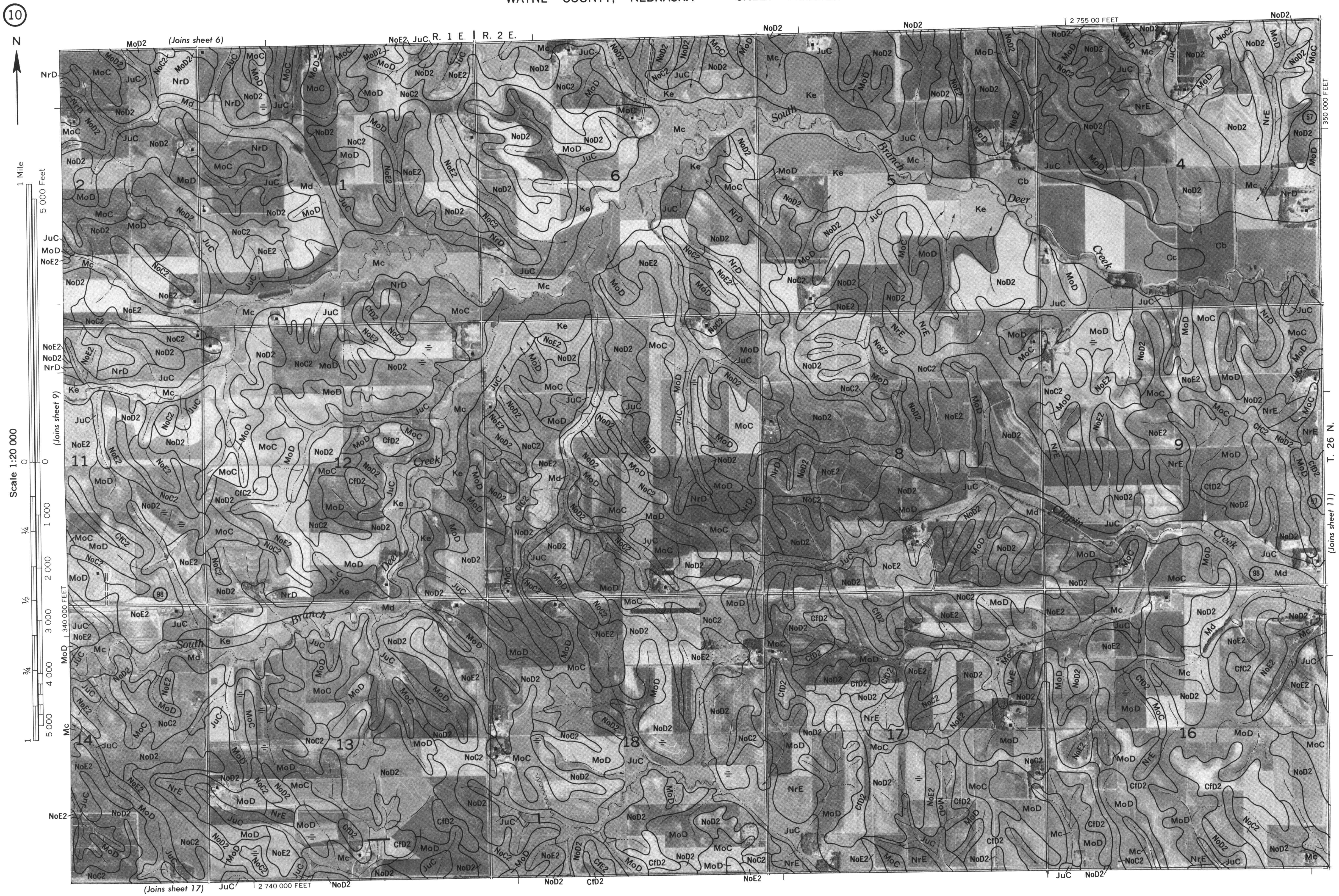
WAYNE COUNTY, NEBRASKA NO. 9

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 10



WAYNE COUNTY, NEBRASKA NO. 10

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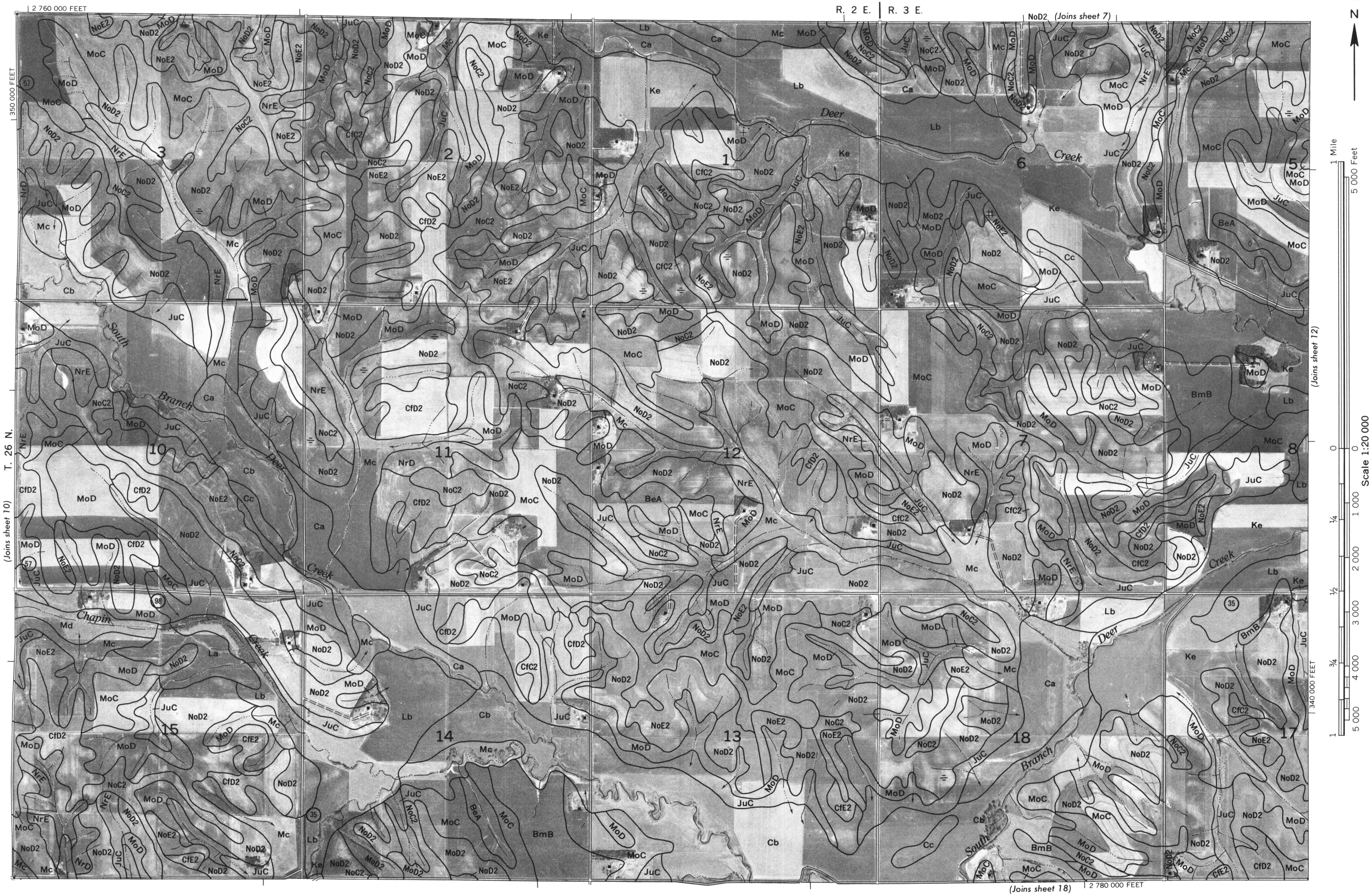

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WAYNE COUNTY, NEBRASKA NO. 11

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 12

WAYNE COUNTY, NEBRASKA NO. 12

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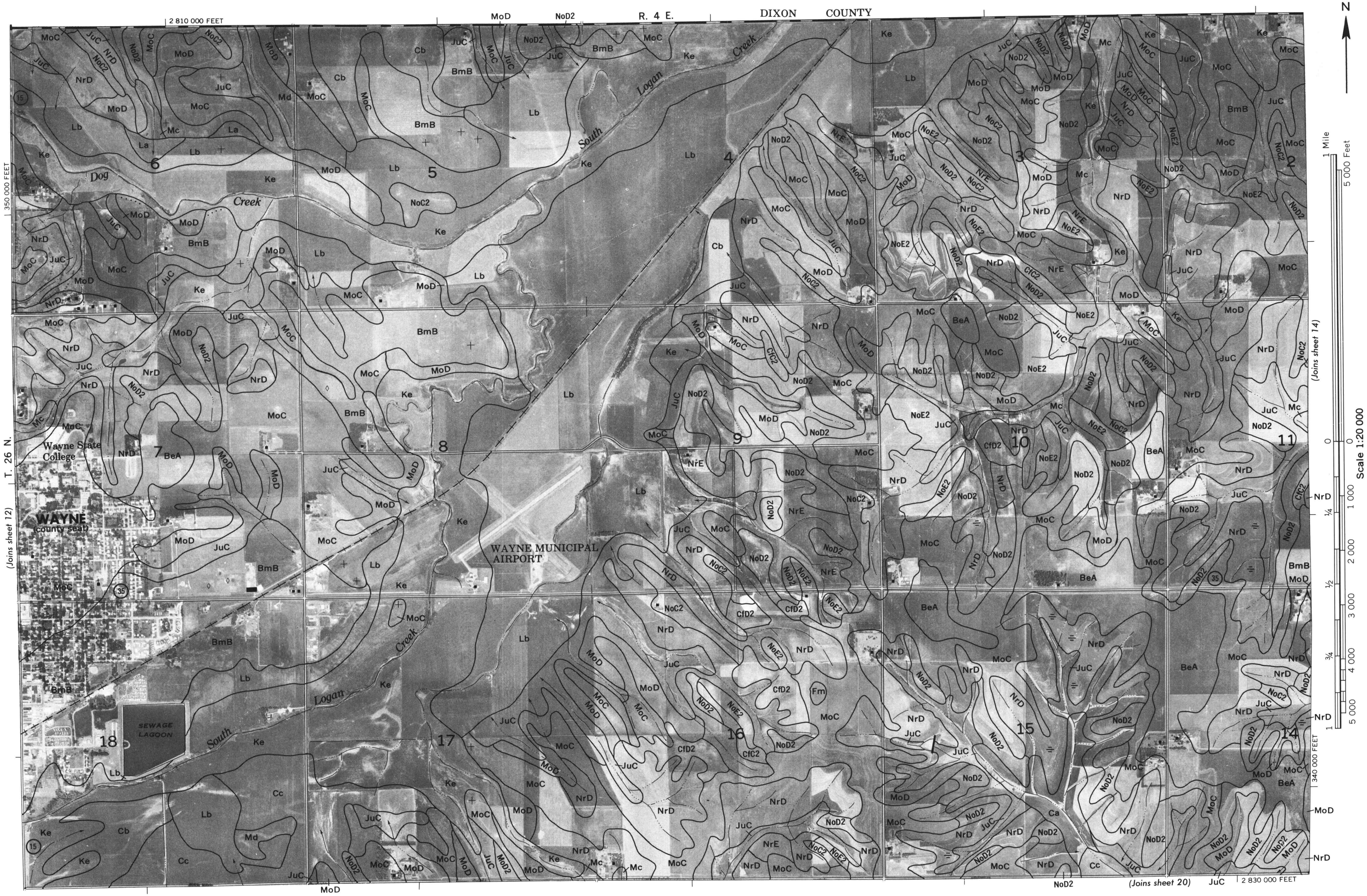

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WAYNE COUNTY, NEBRASKA NO. 13

WAYNE COUNTY, NEBRASKA NO. 14

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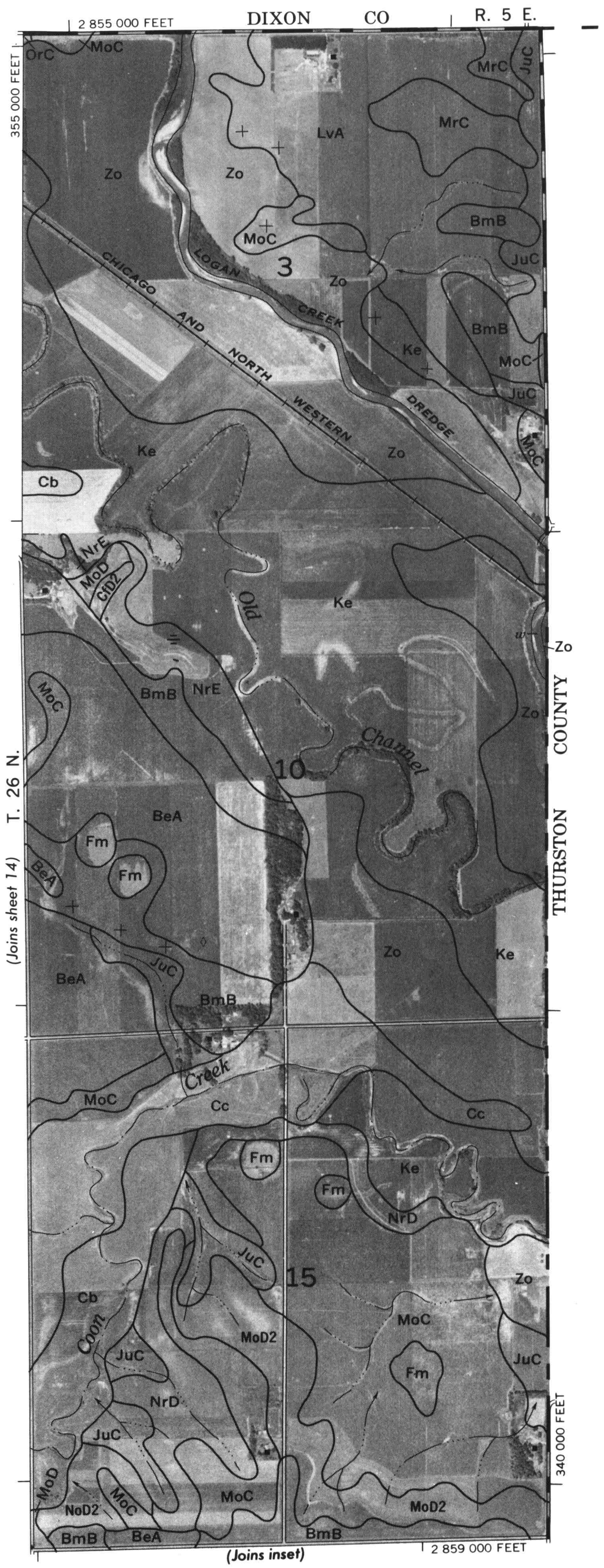
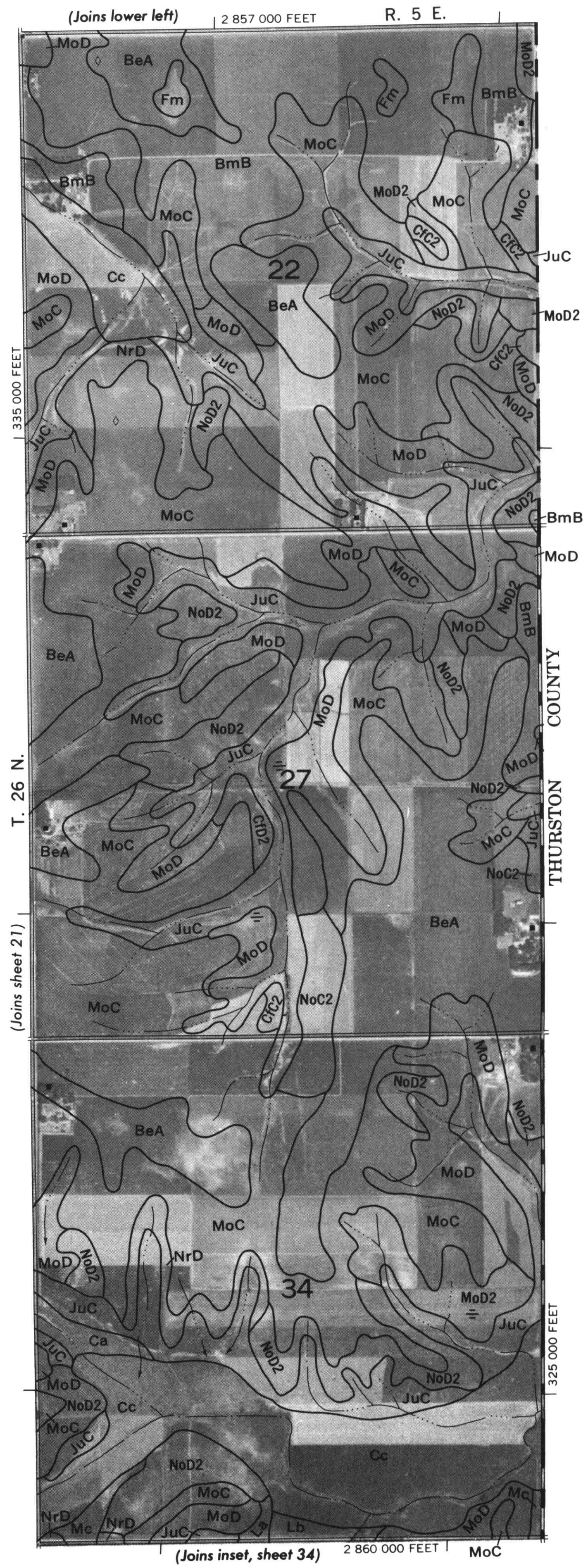
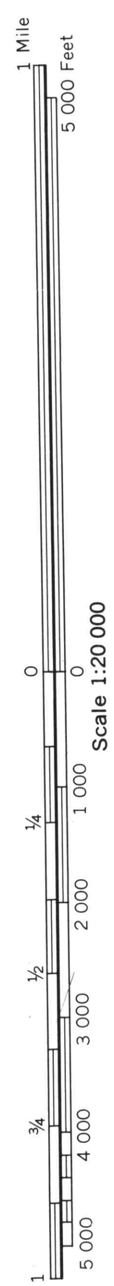
WAYNE COUNTY, NEBRASKA NO. 15



4000 AND 5000-FOOT GRID TICKS



3000 AND 5000-FOOT GRID TICKS



16

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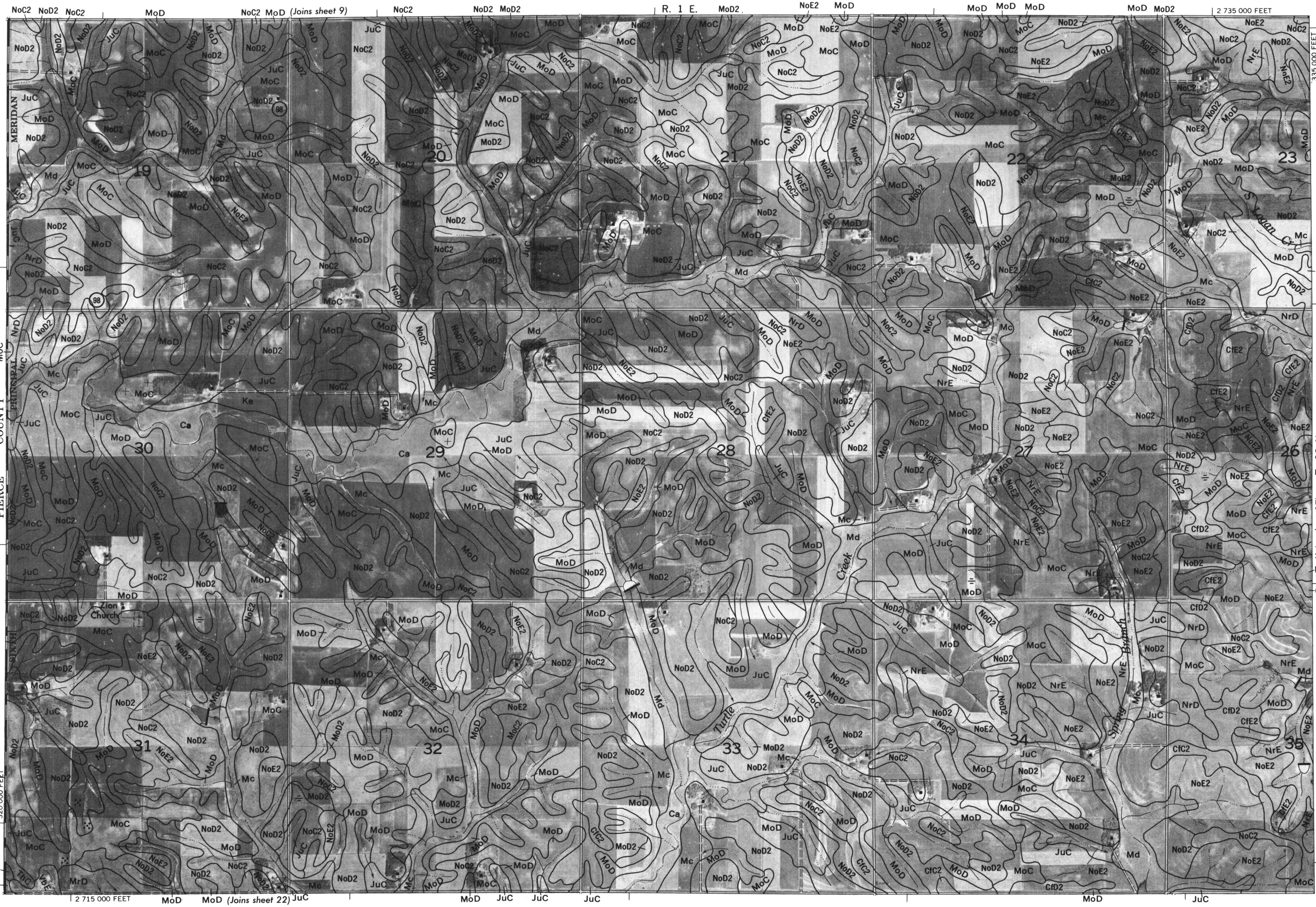


Scale 1:20 000

1 Mile

5 000 Feet

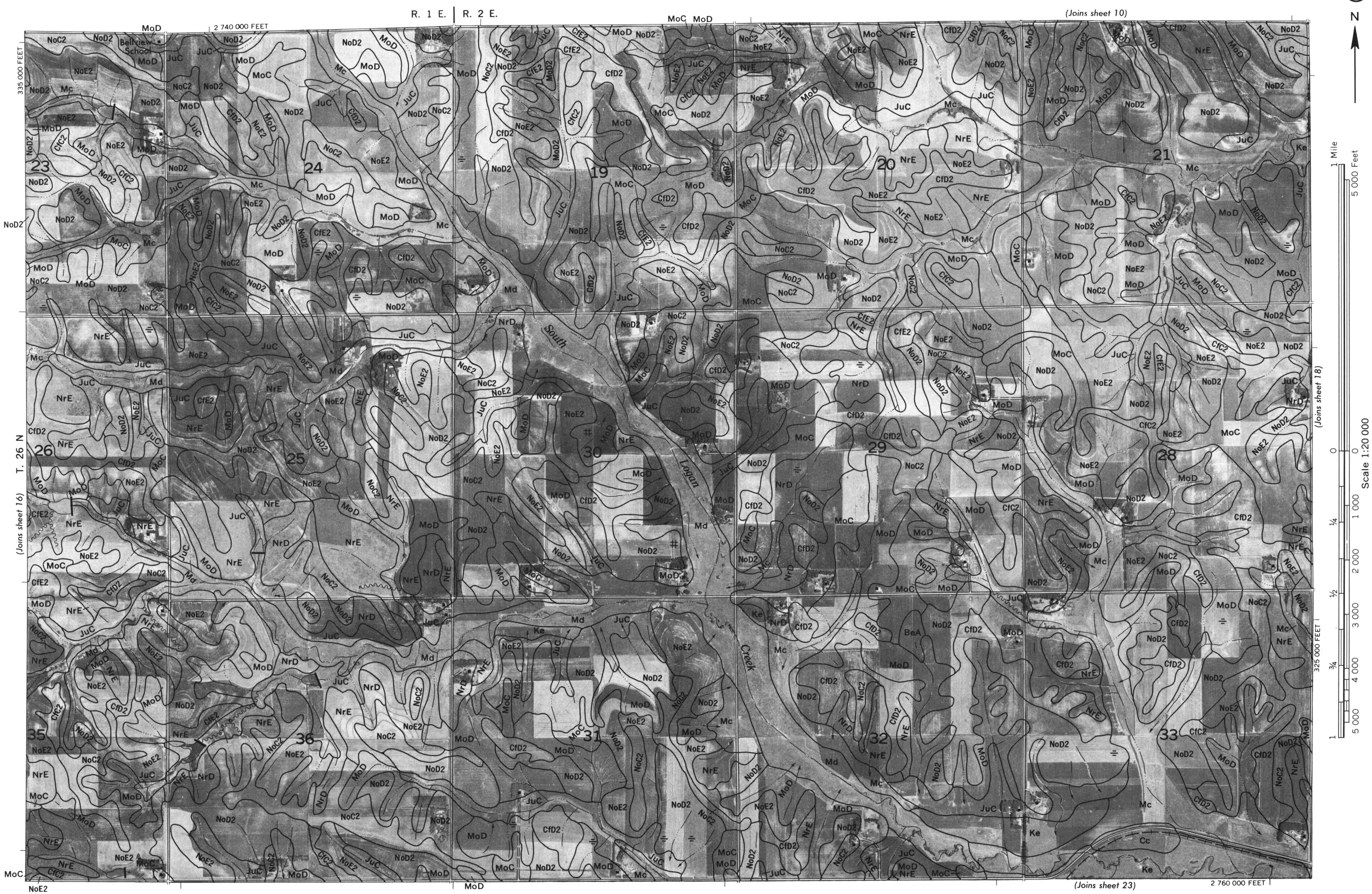
0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

WAYNE COUNTY, NEBRASKA NO. 16

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.



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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 17

WAYNE COUNTY, NEBRASKA NO. 18

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 19

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 20

N

Scale 1:20 000

1 Mile — ¾ — ½ — ¼ — 0

5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000

WAYNE COUNTY, NEBRASKA NO. 20

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 21

21

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 21

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 22

N

Scale 1:20 000

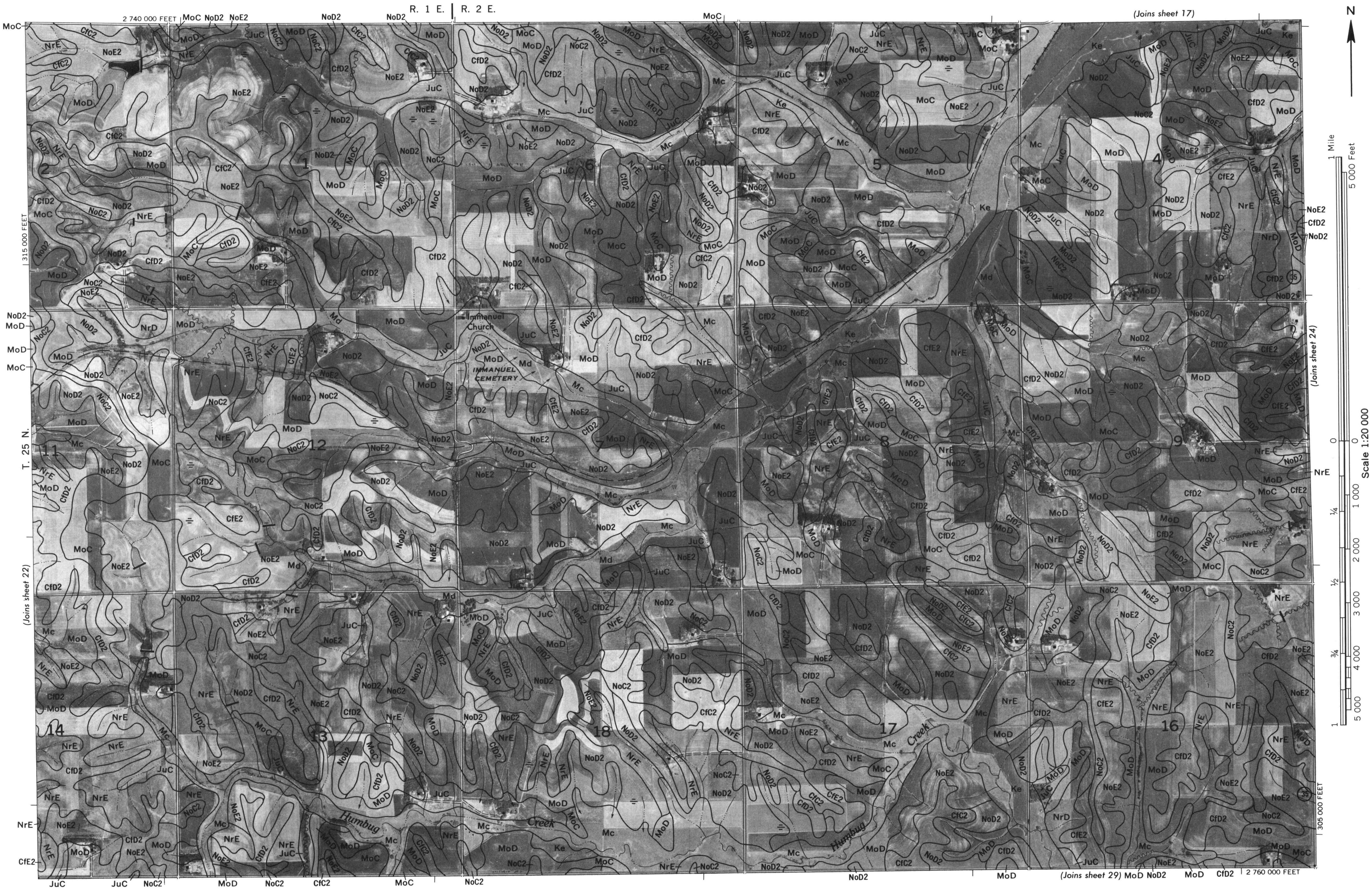
0 ¼ ½ ¾ 1 Mile

0 1 000 2 000 3 000 4 000 5 000 Feet

WAYNE COUNTY, NEBRASKA NO. 22

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.



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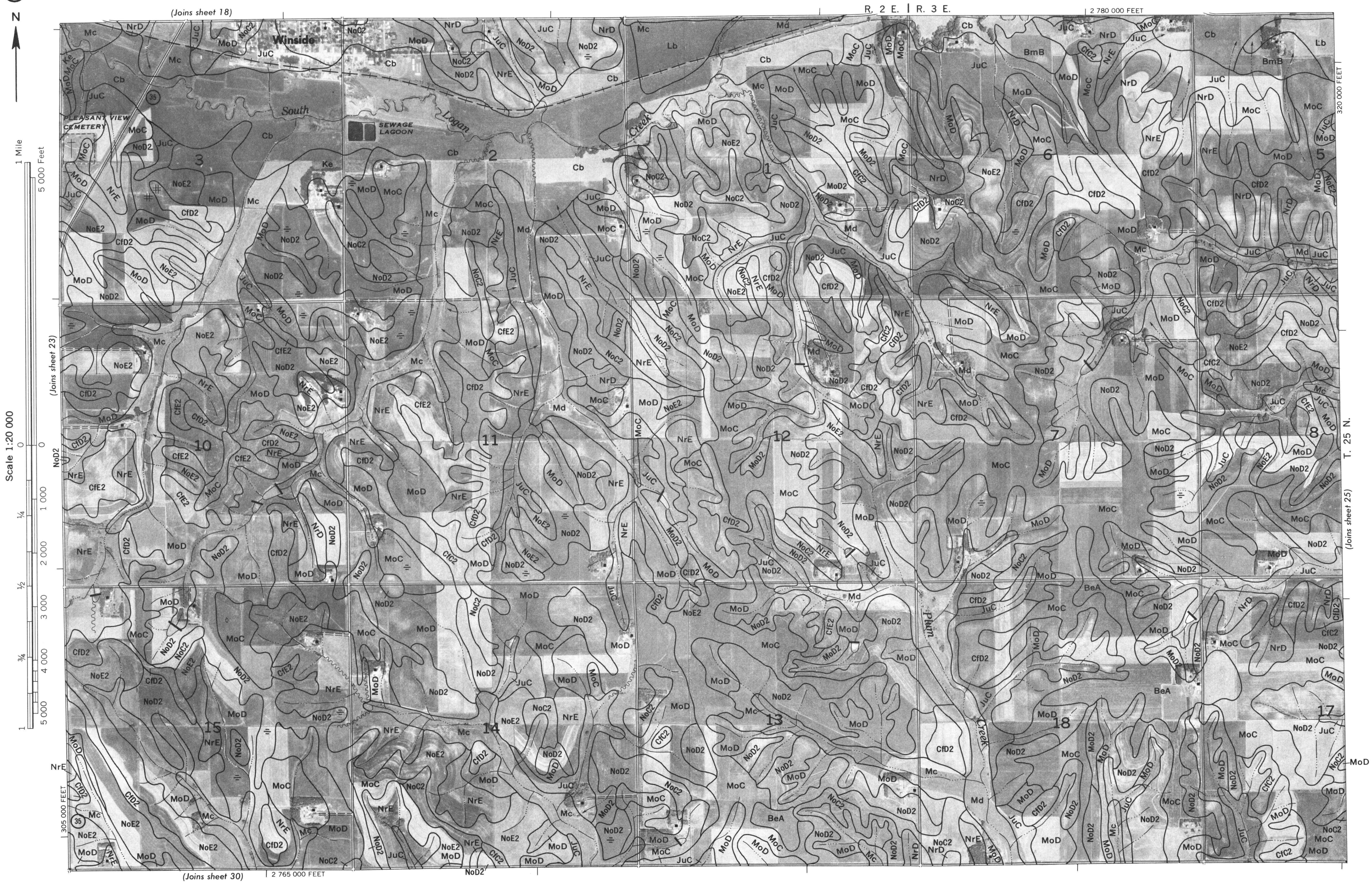
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 23

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 24

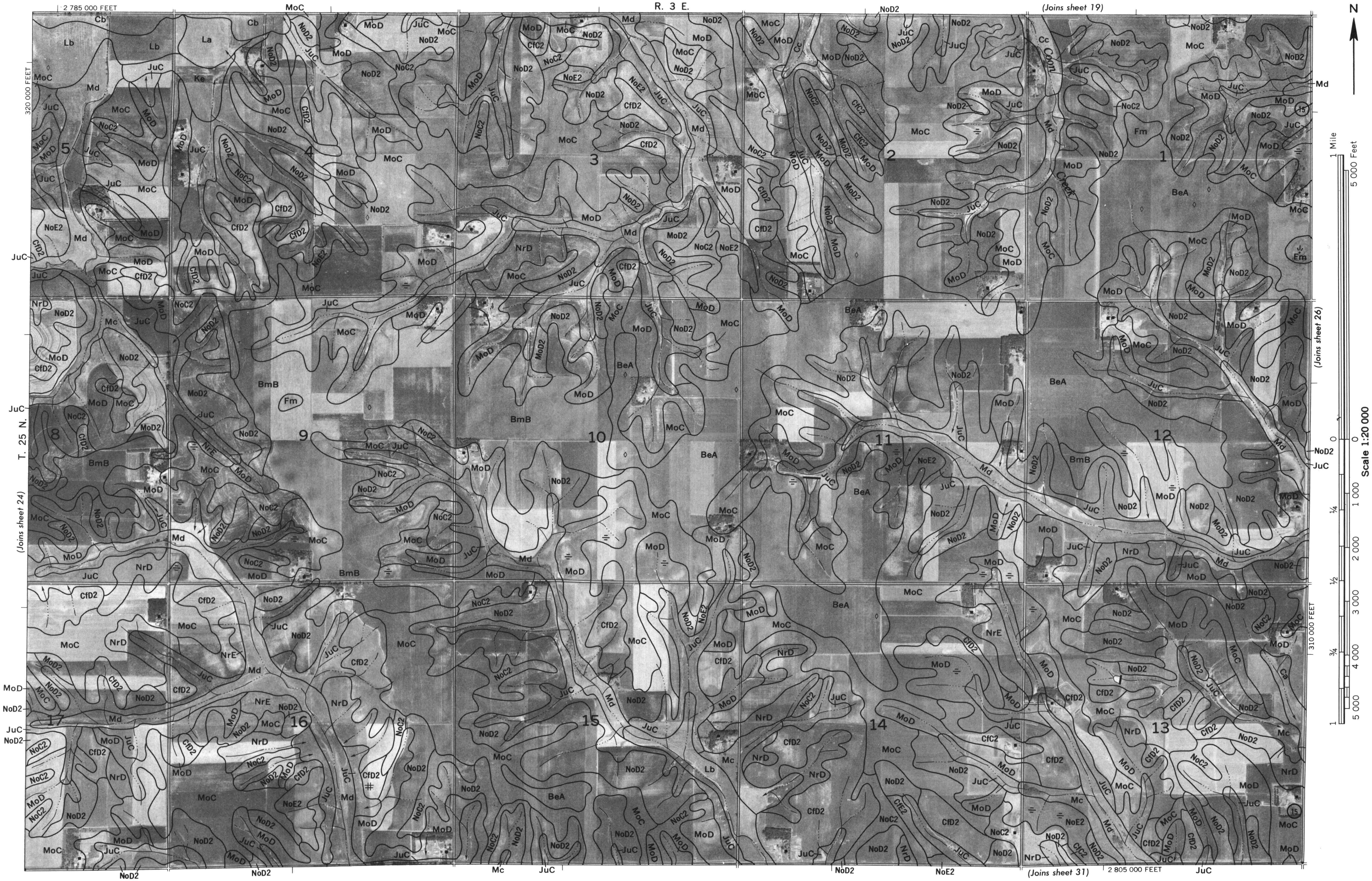


WAYNE COUNTY, NEBRASKA NO. 24

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

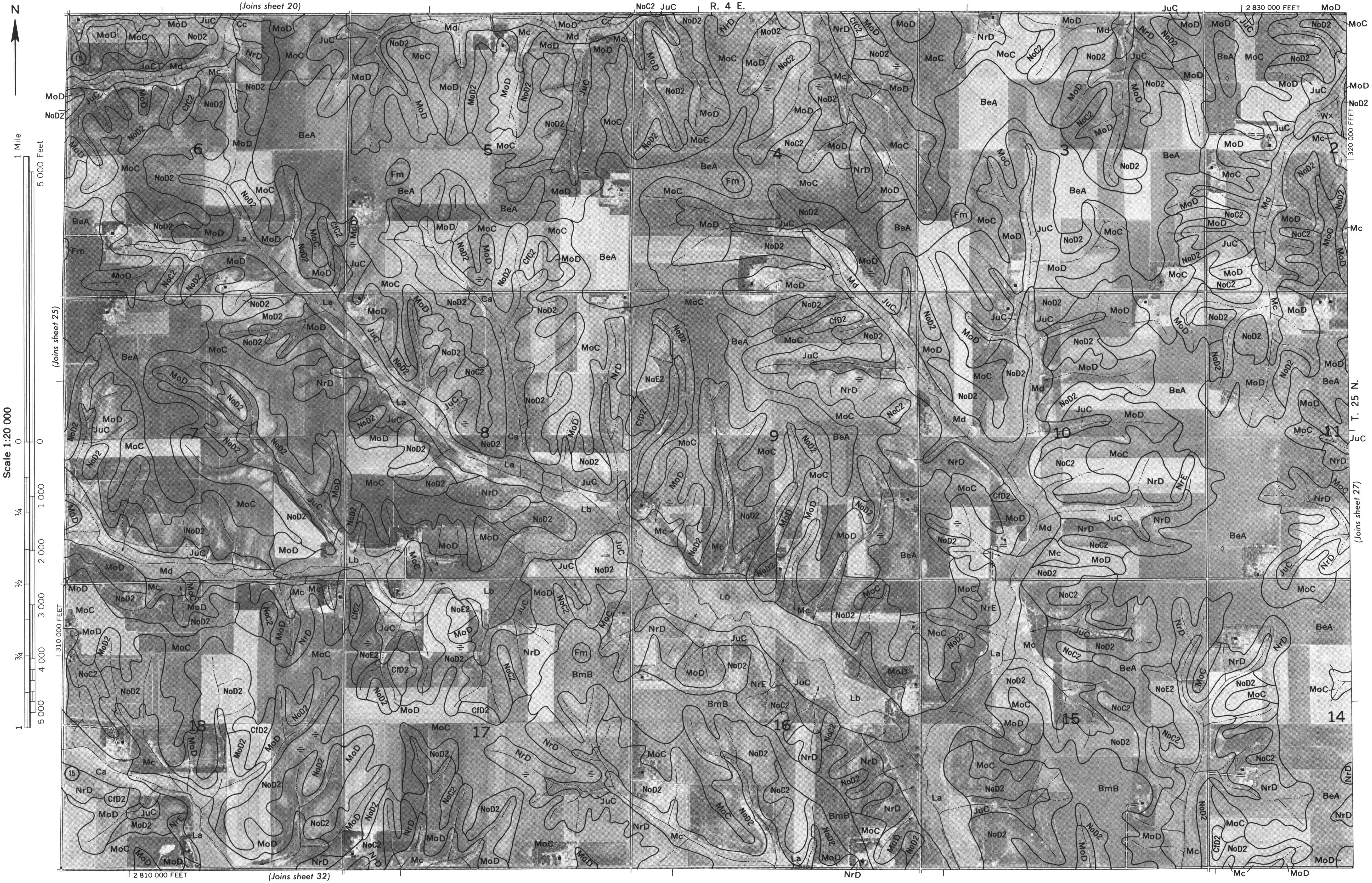
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 25

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 26



WAYNE COUNTY, NEBRASKA NO. 26

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

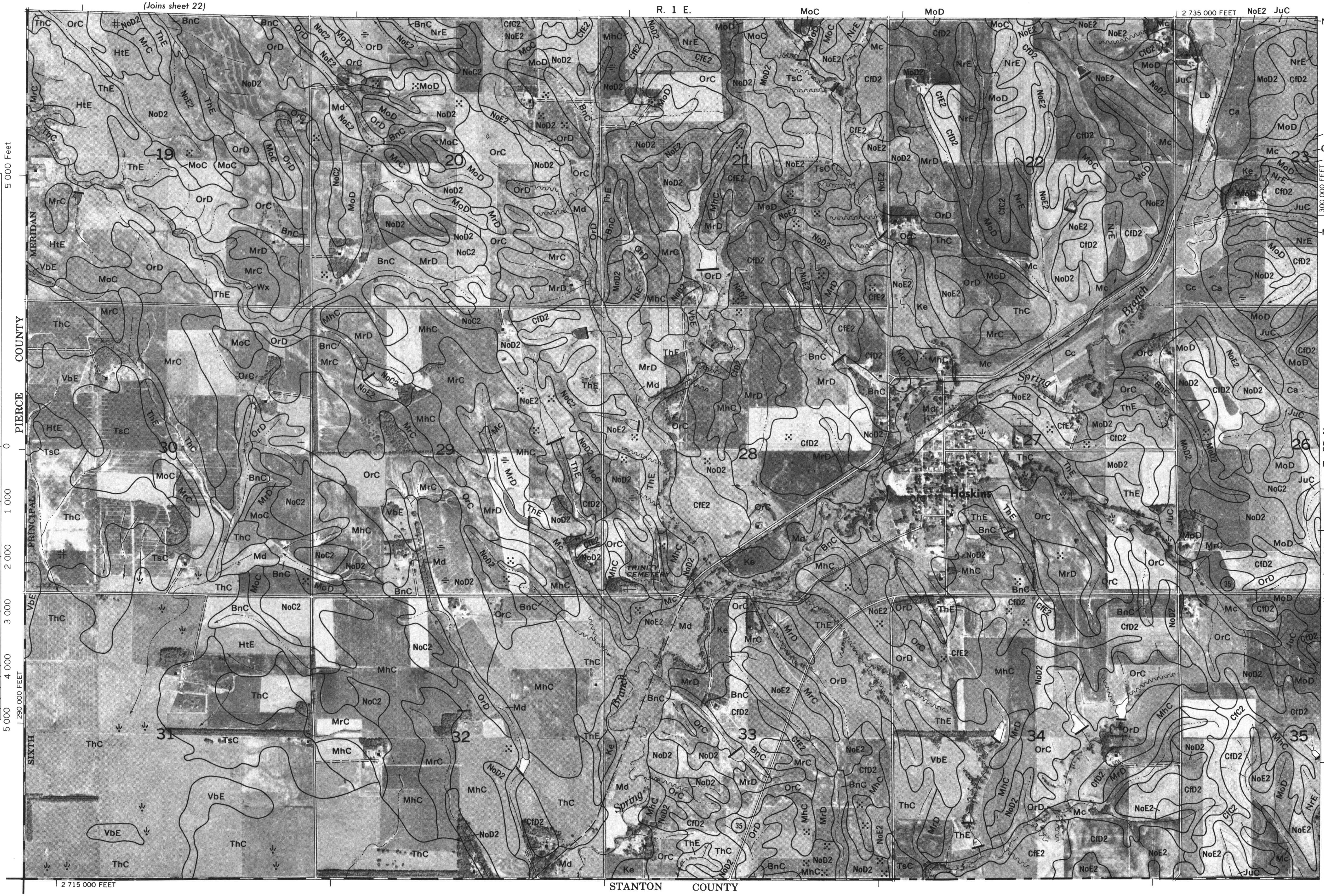
WAYNE COUNTY, NEBRASKA NO 27

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 28

N

Scale 1:20 000

1 Mile · 5 000 Feet · 0 · 1 000 · ¼ · 2 000 · ½ · 3 000 · ¾ · 4 000 · 5 000 · 1



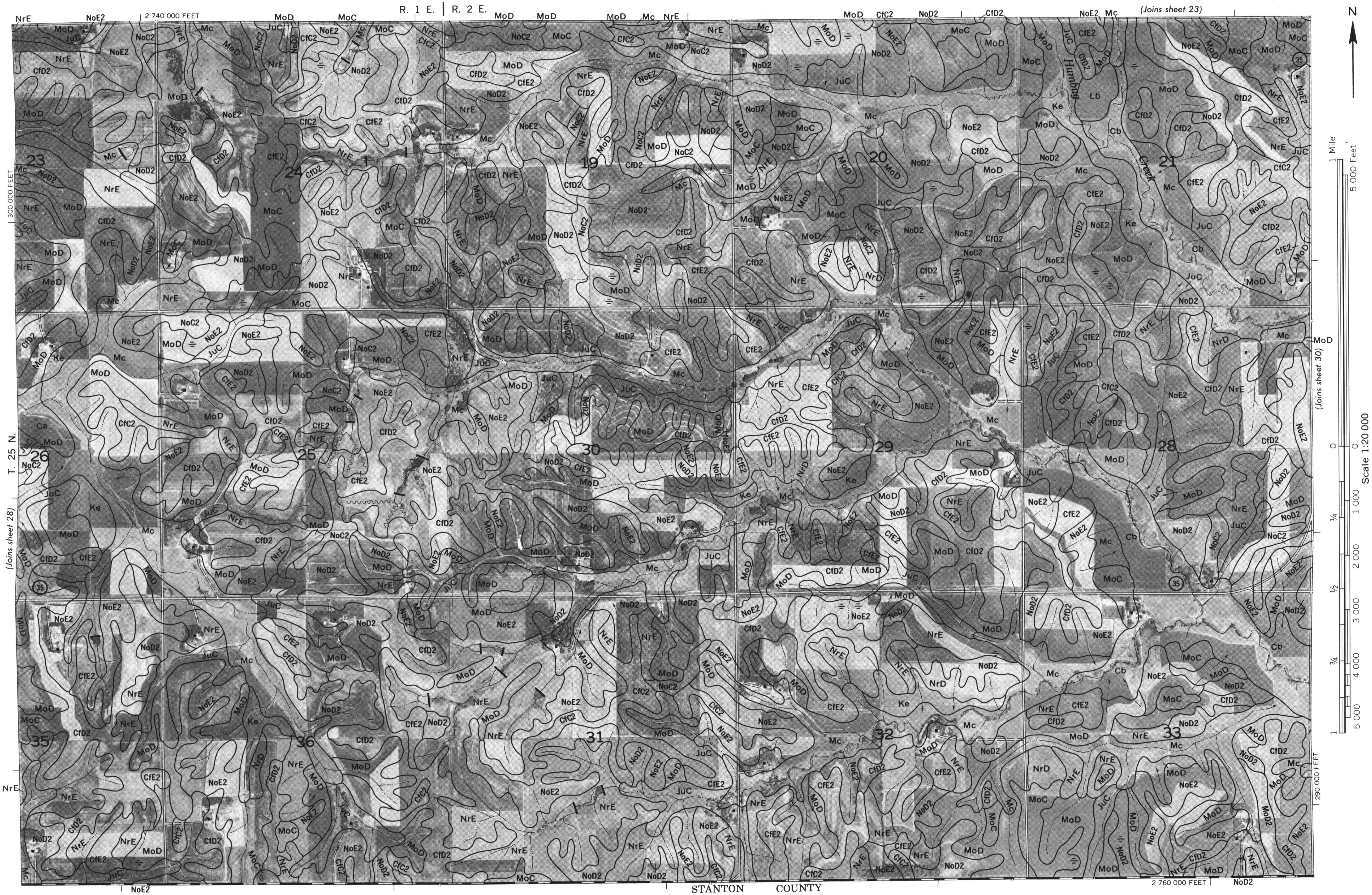
WAYNE COUNTY, NEBRASKA NO. 28

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.

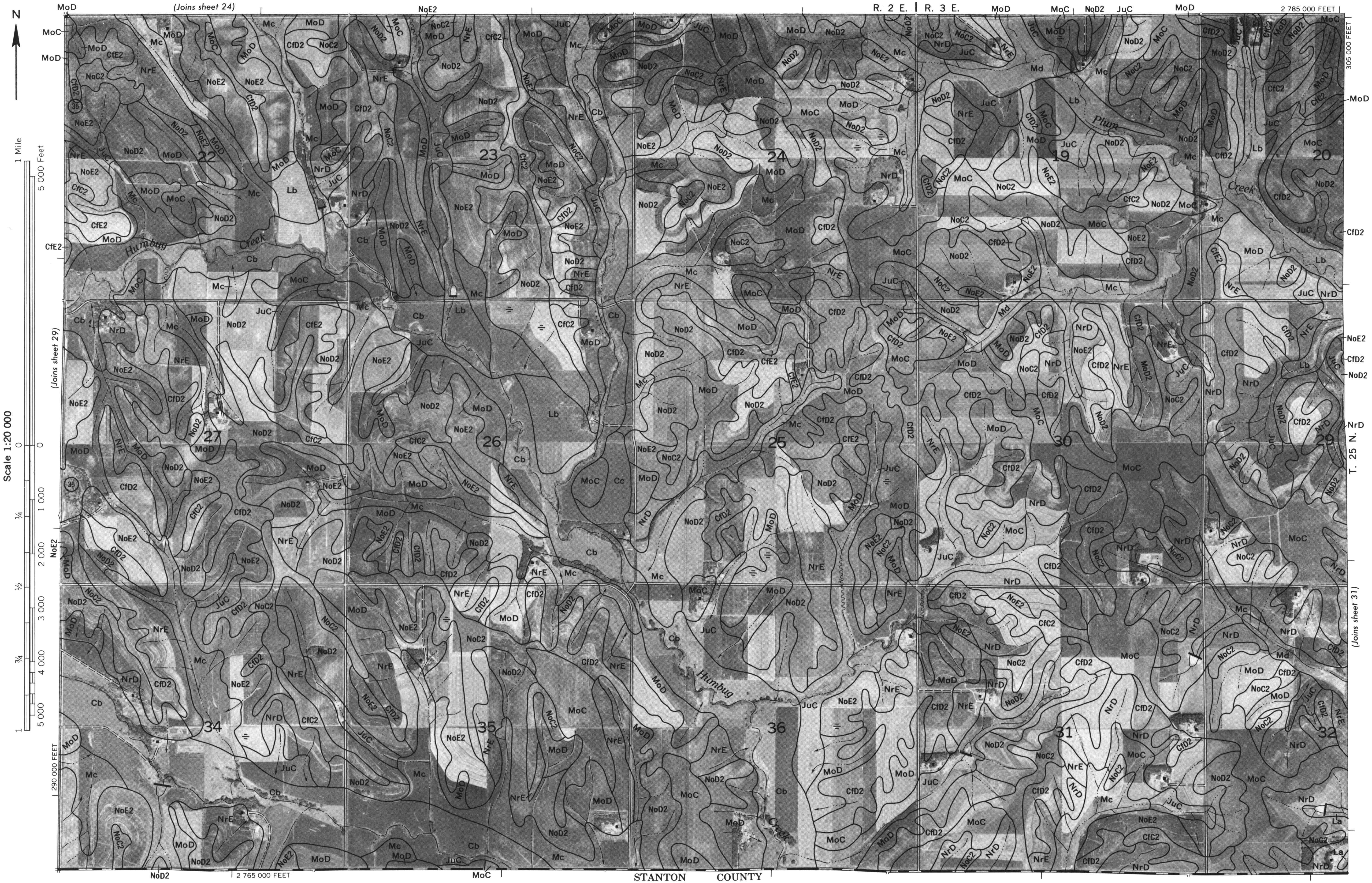
WAYNE COUNTY, NEBRASKA — SHEET NUMBER 29



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 29

WAYNE COUNTY, NEBRASKA — SHEET NUMBER 30



WAYNE COUNTY, NEBRASKA NO. 30

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

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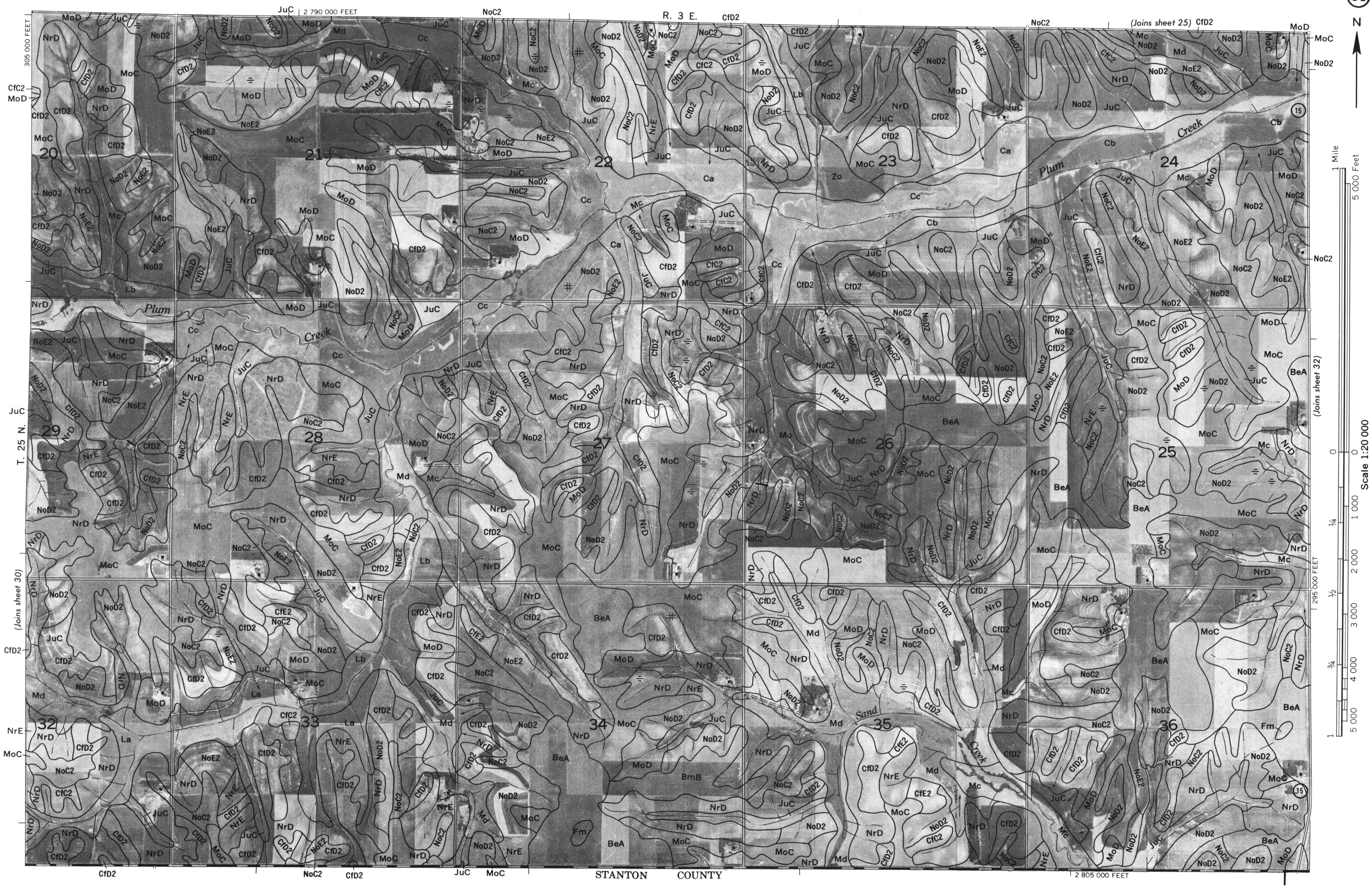
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 31

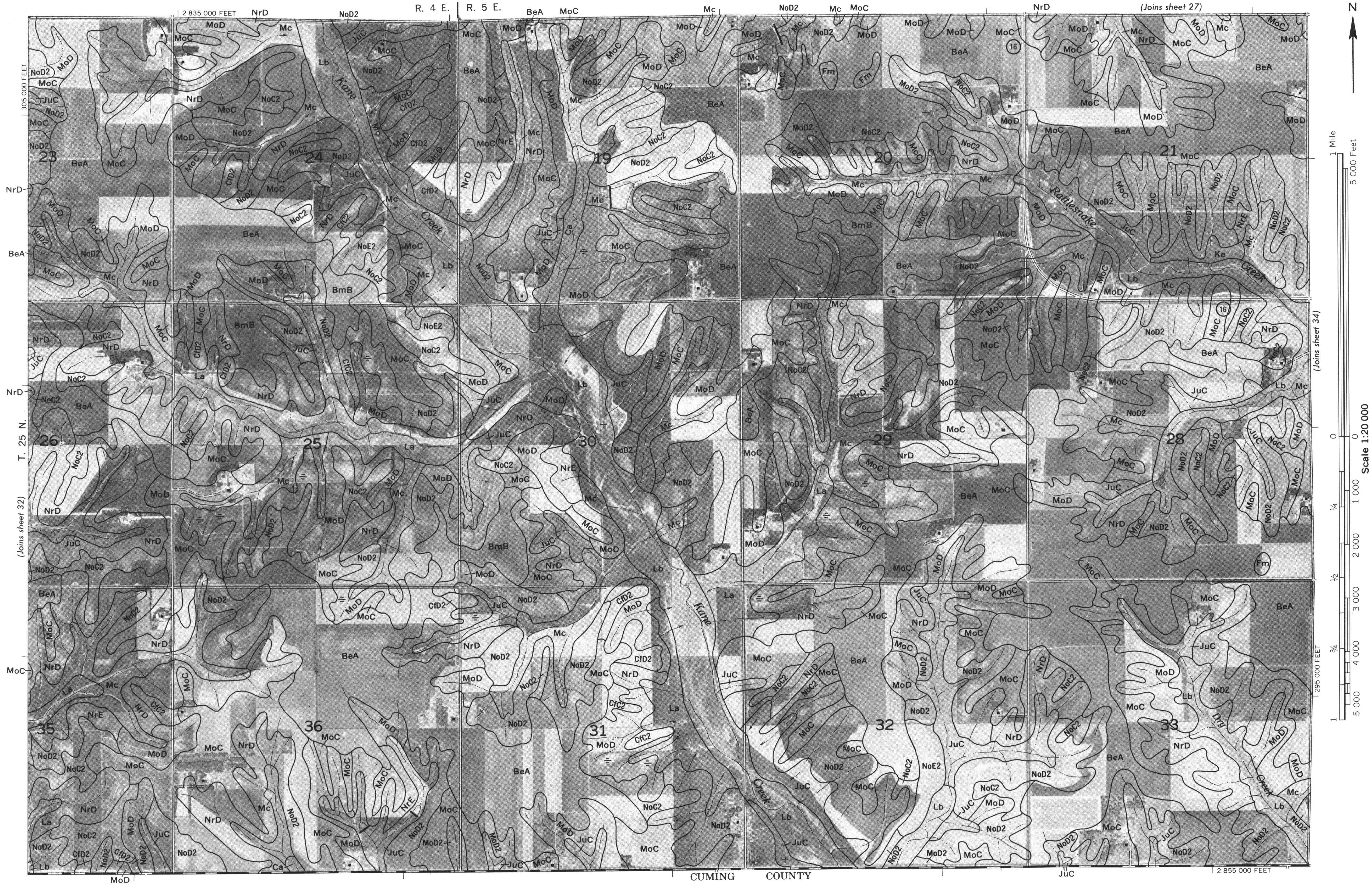


WAYNE COUNTY, NEBRASKA NO. 32

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the University of Nebraska, Conservation and Survey Division.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.
Land division corners are approximately positioned on this map.

WAYNE COUNTY, NEBRASKA NO. 33

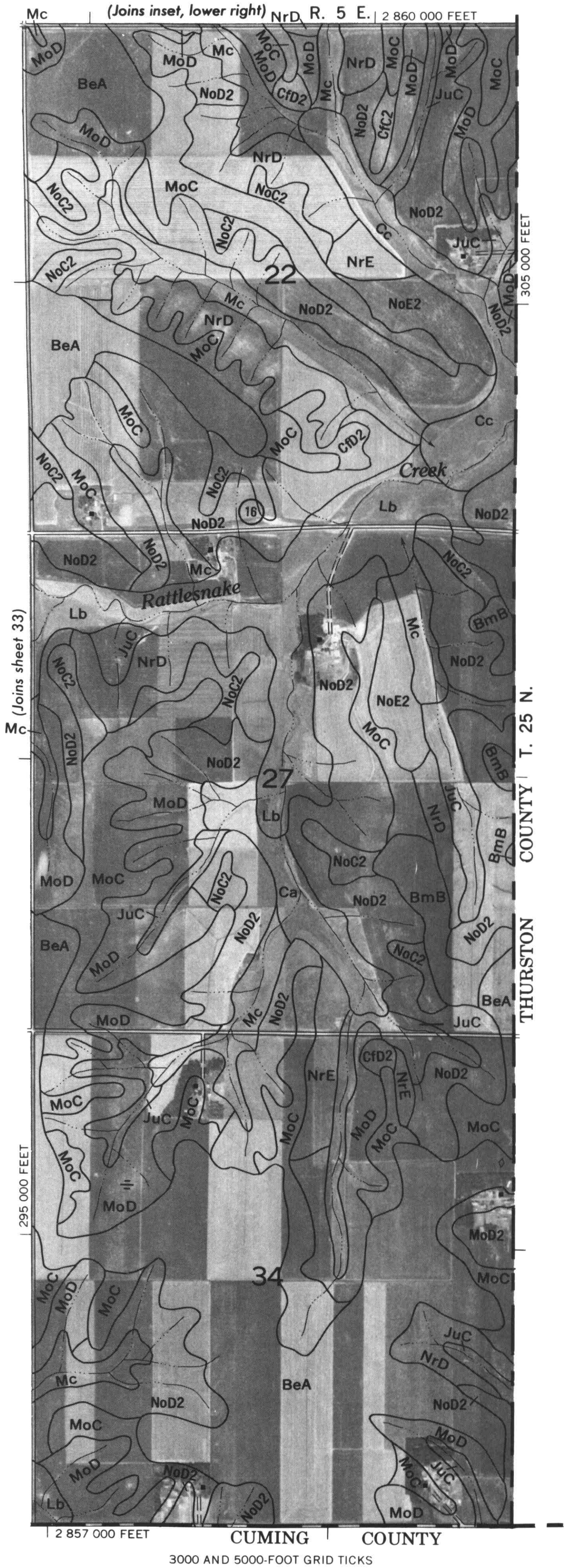
WAYNE COUNTY, NEBRASKA — SHEET NUMBER 34

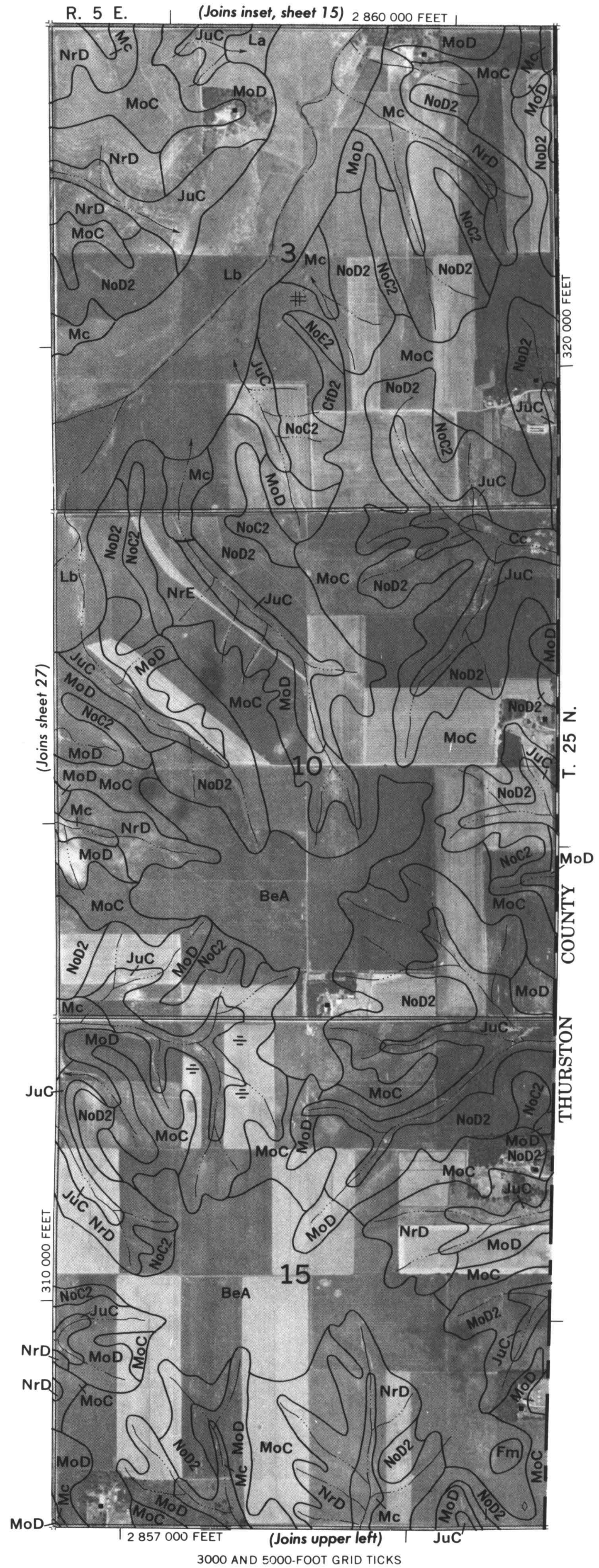
N

Scale 1:20 000

1 Mile

5 000 Feet





WAYNE COUNTY, NEBRASKA NO. 34

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Nebraska coordinate system, north zone.

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